A

REPORT

ON THE

GEOLOGICAL SURVEY OF CONNECTICUT.

BY

CHARLES UPHAM SHEPARD, M. D.

PUBLISHED UNDER THE DIRECTION OF HIS EXCELLENCY,

HENRY W. EDWARDS, GOVERNOR OF THE STATE.

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1837.

Abstract from the Annual Message for 1835, *of Gov.* EDWARDS, *relating to a Geological Survey of the State.*

"The mineralogical treasures which have been developed within a few years and which are constantly coming to light in different parts of our country, give us reason to believe, that we have not as yet availed ourselves to the extent that we might of this source of wealth, and suggests the expediency of a more systematic examination than has hitherto taken place. In some instances this has been done under the public patronage, and by public authority. An examination of the kind in our State, might lead to some important discoveries. An accurate and thorough geological and mineralogical survey by scientific men, if it should not result in any immediate discoveries of moment, would at least have the effect of aiding individuals in their future researches on their own lands. Much labor has been expended, and money wasted, in the search after metals and minerals, which a knowledge of those substances and the relative position they uniformly occupy, would have shown to be useless.

"The geological character of a country indicates its topographical features; and a geological map would serve as a guide, in the examination and selection of routes for rail-roads and canals, and internal improvements of every kind, the location of which depends on the topical features of the country through which they pass. A survey of the kind referred to, would furnish every individual with such information respecting his possessions, as would guard him against the wiles of prowling speculators. Much labor has been bestowed on this subject, and much information collected by individuals in different sections of the State, and it is important, that this information should be embodied and preserved; the expense would be trifling, and bear but a very small proportion to the benefits which may be derived from it. This is a subject in which the whole community has a deep interest, and it is recommended that immediate measures be taken for its accomplishment. Similar surveys have been already had in some of the states; and the attention of others is turned to the subject. Let us not be deficient on our part; we have heretofore furnished, and we can still furnish, our full quota to those economical and scientific researches which seem to be the order of the day."

Action of the Legislature on the above recommendation.

"*Resolved*, That the Governor be and is hereby authorized to appoint a committee of suitable persons to make a geological survey of the state of Connecticut, and to report the same to the General Assembly at their May Session of 1836.

"*Resolved*, That the property of such survey shall be in and belong to the State, and shall be disposed of as the General Assembly may direct."

Abstract from the appointment of the surveyors by the Governor.

"HENRY W. EDWARDS, Governor of the State of Connecticut, to JAMES GATES PERCIVAL and CHARLES UPHAM SHEPARD,—greeting: Pursuant to resolves passed by the General Assembly of Connecticut, at Hartford, in May, 1835, I do appoint you, said PERCIVAL and SHEPARD, a committee to make and complete the survey and report in said resolves, to perform the duties thereof, and obey the instructions from time to time received from the proper authority.

"Given under my hand and official seal at New Haven, this 15th day of June, A. D. 1835. HENRY W. EDWARDS."

The Legislature of 1836 accepted the reports of the commissioners, and authorized the continuation of the survey for another year; but recommended a postponement of publication until the necessary researches were completed.

The economical and mineralogical report was submitted to the Legislature of 1837, and gave rise to the following

Report of the Committee on the Geological Survey.

"The joint committee on the Geological and Mineralogical Survey of the State, to whom was referred the Special Message of the Governor and the accompanying papers relating to the mineralogical department of said survey, having had the same under their consideration, REPORT,

"That Prof. SHEPARD has brought his examination into the mineralogy of the State to a close, and the results of his labors have been before us in a highly interesting and valuable Report. This Report, embracing the statistics of all our present mineral resources, the condition of our mines, quarries and diggings of every description, and suggestions as to the most profitable manner of working them both to the proprietors and the public, all of which are capable of immediate application,—your committee recommend should be immediately published. This Report will attract public attention to the mineral wealth of the State, which is shown to be most abundant, and only stands in need of capital and enterprise to be profitably developed. It will apprise landed proprietors of resources, of which in many instances they are now ignorant; and in others will afford them information how to turn to increased account such as they already know to exist. It teaches what things may be expected in certain districts of the State, points out the mode of searching for them and the way to identify them when found.

"Another consideration which should determine its immediate publication is, that it may receive the supervision of Prof. SHEPARD while passing through the press; a supervision altogether necessary from the nature of the subjects treated of, and which it may not be in his power to extend after this summer. For this reason too, your committee recommend its being published at New Haven, where Prof. SHEPARD resides, and where publishers are more accustomed to this kind of work than elsewhere in the State.

"The document will constitute an 8vo. volume, or pamphlet, of one hundred and fifty pages; and if published in the style in which these surveys are done in other states, will cost about twenty-five cents a copy. Your committee, therefore, recommend an appropriation of a sum of money not exceeding five hundred dollars,

or such less sum as his Excellency the Governor may contract for, for the publication of two thousand copies. That of this number, the Governor be authorized to distribute copies in the following manner:—

"Two copies to the library of Congress; two copies to the Governor of every state in the Union; two copies to the library of Yale College, of Washington College, and of the Wesleyan University of this State,—and to each of the State Officers; one copy to each of the Judges of the Supreme Court; one copy to each of the Judges of the County Court and to each Probate Judge of this State, who are not members of this Legislature; one copy to each member of the two Houses of the present Legislature; one copy to the town clerk of every town in the State; fifty copies to remain at the disposal of Prof. SHEPARD, and the same number at the disposal of his Excellency, the Governor.

"And the Governor is further authorized to furnish any bookseller such number of copies, to be disposed of on such terms as his Excellency may deem proper, for the benefit of the State.

"The disposition of this Report which your committee have recommended, in case it should be published, will only reach about one half the number proposed to be printed; and will leave one thousand copies to be taken up by private sale, or disposed of by the next General Assembly.

"With these considerations, your Committee would respectfully recommend the adoption of the accompanying resolution. All of which is respectfully submitted.

JAMES BEEBE, *Chairman.*"

The above report was accepted and the resolution passed relative to the publication of the same.

"*Resolved by this Assembly*, That two thousand copies of Prof. SHEPARD's Report on the Mineralogy of the State be published under the superintendence of the author, and that a sum of money not exceeding five hundred dollars be appropriated to defray the expenses,—and that the Comptroller of public accounts is hereby authorized to draw an order on the Treasurer for such sum, not exceeding five hundred dollars, to be paid out of any money not otherwise appropriated,—and his Excellency, the Governor, is hereby appointed Commissioner to see the object of this resolution effected."

REPORT.

TO HIS EXCELLENCY

GOVERNOR HENRY W. EDWARDS.

SIR,

I HAVE the honor, herewith to submit to your Excellency the report I was commissioned to make relative to the geological survey of the State. In accordance with my instructions, I have chiefly confined my attention to mineralogy, leaving to my colleague, Dr. PERCIVAL, the department of geology proper, excepting so far as relates to the economical applications of that science, and the collection of a suite of specimens to illustrate the leading formations of the State.

The time allotted to the duty has been inadequate to a complete execution of the task. For although the area of the State is small, yet the proportion of rocky surface to be examined is large. Under these circumstances I can but congratulate myself, that this report is less imperfect than it would have been, but for the many materials already accumulated by several individuals previous to the commencement of the undertaking, and which were chiefly to be found in the *American Journal of Science and Arts*. To no individual is his native State so deeply indebted as to the well known Editor of the above named journal, for the disinterested services he has rendered with a view to develop her mineral resources, and for the public spirit with which he has labored to convince the community of the important practical bearings of geology and mineralogy. The late Col. GEORGE GIBBS was likewise an early and a successful observer of the mineralogy of this State. Prof. HITCHCOCK of Amherst, and Lieut. MATHER of Albany, have each contributed valuable observations. Other individuals whose services deserve commemoration are, Dr. WEBSTER of Cambridge, the late Prof. BOWEN

of Nashville, Mr. J. P. Brace and Alfred Smith, Esq. of Hartford, and Dr. Percival. During the progress of the survey also, I have been favored with many useful hints from numerous cultivators of mineralogical science residing in different parts of the State; among whom I am bound to mention, Col. Charles Griswold of Lyme, Dr. Hudson of Torrington, Mr. Boyd of Winsted and Judge Smith of Woodbury. In addition to the materials thus derived, I may perhaps be permitted to observe, that I have incorporated with this report no inconsiderable number of facts collected by myself, during many excursions through the State previous to my appointment by your Excellency. But notwithstanding all the aids and opportunities I have enjoyed, justice to the resources of the State obliges me to remark, that I am far from entertaining the opinion that her mineral wealth is yet fairly laid open to view. On the contrary, a glance only has been obtained, but enough it is believed, to awaken fresh zeal and confidence in relation to what remains concealed.

The opinion which has until recently prevailed respecting the metallic treasures of Connecticut was certainly erroneous. Her iron mines have often been represented as fast tending to exhaustion, and her iron manufacture as being attended with little advantage. One of these mines however, has long yielded its proprietors a clear annual profit of about five thousand dollars; while many handsome fortunes have been realized from the iron business in that section of the State. Instead of a failure in the supply of ore, it may confidently be asserted, that not one half of the workable beds in that district are as yet fairly uncovered; while it is equally true, that as soon as proper economy in the burning of charcoal and the radical improvement of the hot air-blast are introduced, cast iron will be afforded at one half its present cost, and this without any diminution of profit to the manufacturer. An iron resource also, of great value, in the steel-ore of Roxbury, has hitherto been wholly unappreciated. And if our copper region has not as yet been a source of income to the State, it is not surely because we are deficient in this valuable metal, as the plainest indications show; but for the reason that enterprise and capital have been wanting to open these deposits: for workable veins of copper, unlike the other metals, rarely attain the surface of the earth. The neglect of these mines however, until

the present time will prove less a detriment to the public wealth from the fact, that the working of deep mines (in consequence of the economy introduced into the system of furnishing supplies requisite to such undertakings, and the saving of power in the improvement of the steam engine) is now carried on, at less than one half the cost incurred twenty-five years ago. Cobalt, zinc, lead, bismuth and silver, are also to be included on the list of metals which will one day augment the wealth of the State; nor are the indications of tin, a metal most of all to be desired, wholly wanting. Without wishing by unauthorized statements to allure the inconsiderate, and those not possessed of the necessary resources, into a branch of business where the chances of success would be greatly against them, I still feel it a duty to give it as my decided conviction, that the iron and copper mines of the State constitute a legitimate object for the investment of capital; and that if the enterprise of opening these resources is committed to persons of integrity and skill, it must prove eminently remunerative in its result, both to those immediately interested and to the population generally. For it is most obvious, that the working of rich mines will not only react in a favorable manner on the agricultural interest, by advancing the price of farming produce, but will also promote the public prosperity by leading to the free circulation of capital, the improvement of roads, and to habits of increased industry in the people.

The advantages possessed by the State in respect to materials for architecture, decoration and porcelain,—for flagging, quicklime and cements,—if on the whole better known and admitted than those connected with her metallic resources, are still far from being appreciated to their full extent. This report it is hoped will make it evident, that they are not only bestowed upon us with a liberal hand, but that they have their value greatly enhanced by the topographical features and geographical position of our territory. The Sound affords a navigation secure almost as a river along the whole face of our southern boundary, while the Connecticut flows like a canal across the centre of the State, and smaller streams and harbors cleave and indent the coast. Large and growing maritime cities must still continue to depend upon us for the supply of much of their most valued architectural materials; and in the improvement of harbors and the construction of fortifications, we are doubt-

less destined to contribute as largely as heretofore. To an agricultural people, the possession of so many quarries under such circumstances, is peculiarly favorable; surpassing perhaps in direct advantages to them, the existence of mines. For the working of these, together with the smelting of ores, are arts of slow and difficult acquisition, requiring in many instances the investment of an immense capital, which, in the fluctuating successes that often attend such operations, must sometimes remain unproductive for an entire generation. But the working of a stone quarry is little more than a branch of agriculture. A farmer supplying himself with a few additional instruments and materials, may work his ledges as well as his soil, according as one or the other rewards him best for his labor; or he may manage both, without prejudice to either. His labor in each case, is alike conducted in the broad light and fresh air of open day.

As it appeared important to connect with this report whatever seemed likely to promote the future development of valuable minerals in the State, I have felt myself called upon to introduce occasional details respecting the uses of minerals not commonly understood, and also to give very briefly the rules for detecting and recognizing such substances. And as encouragement to research, as well as for the purpose of making the public generally acquainted with our resources, I have included frequent statistical notices relating to the number of hands employed in various mines and quarries, and to the amount of products annually afforded.

How far the results I am herewith able to submit concerning the economical mineralogy and geology of the State will be thought valuable, I am unable to predict. I have however, discharged this part of my duty to the best of my ability, though the restricted period allowed, has compelled me to content myself in many instances with hasty examinations and brief descriptions. That there was room for the performance of many useful services in affording information to individuals in different parts of the State who were occupying themselves with mineral explorations, I am abundantly satisfied; and both my colleague and myself have the satisfaction of knowing, that we have dissuaded from many profitless enterprises not a few of our fellow citizens who stood in need of such advice, while we hope that we have been able also to furnish suggestions to others that will ultimately be promotive of their interests. Without

wishing to speak disrespectfully of a community which has never been placed second to any other in the Union for its widely diffused intelligence and general sagacity of character, I may still be permitted to say, that information relating to the mineral kingdom was almost every where found to be singularly deficient. Other communities no doubt share with us in this defect. Many persons, not otherwise wanting in intelligence, were met with, whose belief in the virtues of the divining rod was unshaken, iron-pyrites was often explored for gold, talcy rocks were ground for plaster, and plumbaginous mica-slate extensively mined for coal! Most fortunate would it have been, could this deficiency have been supplied at an earlier period, as it could not have failed to check an immense expenditure of labor which has been worse than thrown away; since it has always operated more or less to interrupt the industry of neighborhoods, and to bring into unmerited discredit even scientific researches connected with the mineral kingdom.

A scientific report, embracing notices of all the simple minerals of the State, independently of their relations to the other sciences or even to the arts, though uninteresting to the general reader, still seemed to be demanded, not only to supply the wants of the many students of mineralogy in the public institutions of the State where the science is taught, but also for the purpose of indicating with accuracy the numerous productions which still lie dormant as respects any useful applicability, but which the progress of the arts may ere long call into requisition. It may be added also, that it was presumed the scientific community generally, were in the expectation of finding in this report a summary at least of the leading features of our mineral productions, since mineralogy has longer been cultivated and taught as a branch of education here, than in any other section of the country. The subject, for want of space, has necessarily been treated in an imperfect manner; though I venture to hope, that inasmuch as many of the facts are new, it will not be found wholly devoid of interest to the mineralogist. It was certainly an unexpected result to myself, to be able to detect in so small a territory as that of Connecticut, and one whose strata had been so little perforated by mining operations, nearly one half of the well established mineral species hitherto discovered throughout the world, and fully three quarters of all the elements as yet made known to us by chemical

analysis; much less was it anticipated at the outset, that it would become necessary in the progress of the work to add several new species to the productions of the mineral kingdom.

It only remains to remark, that the collection of rocks and minerals by which the subject has been illustrated consists of nearly eight hundred samples, and is carefully arranged in horizontal glazed cases in the State House in this city. The samples are labeled with numbers which correspond of course, to those mentioned in the descriptive catalogue forming a part of the report. Although their selection was made under circumstances not calculated in all instances to secure the most characteristic or showy specimens, yet it is still believed that they communicate a correct general impression of our mineral and rock formations; and it is hoped that they may continue to be preserved with care, if not for useful objects of reference, at least as faithful vouchers to the correctness of most of the facts mentioned in this report.

Trusting that the manner in which that part of the survey assigned to my hands has been performed will not disappoint the reasonable expectations it may have excited in the public mind, or prove altogether unworthy of the confidence with which your Excellency has honored me, I have the honor to remain,

Your Excellency's most obedient servant,

CHARLES UPHAM SHEPARD.

New Haven, May 15th, 1837.

THE report consists of three distinct parts: 1. an Economical report, 2. a Scientific report, 3. a Descriptive Catalogue of the cabinet.

Under the first of these heads, the rocks and minerals hitherto employed, or which are supposed capable of useful applications are treated of; under the second, all the simple minerals are mentioned; while to the last belongs, a description of the samples collected to illustrate the leading features both of the geology and mineralogy of the State.

ECONOMICAL REPORT.

The facts and statements appropriate to this section are brought forward under the following general heads: 1. *Metals*, 2. *Coal*, 3. *Plumbago*, 4. *Gems*, 5. *Polishing and Grinding Materials*, 6. *Soapstone and Potstone*, 7. *Materials for Alcaline and Earthy Salts*, 8. *Materials for Bricks, Pottery, Porcelain and Glass*, 9. *Fire-stones*, 10. *Fluxes*, 11. *Quick-lime and Water-cement*, 12. *Stone-Paints*, 13. *Decolorizing carbonaceous slate*, 14. *Materials for Architecture and Decoration*, 15. *Materials for Flagging, Tiling and Paving*, 16. *Mineral Springs*, 17. *Materials for Agriculture.*

I. Metals.

These will be described in the order of their usefulness to society.

Iron.—But three species of iron-ore capable of yielding this metal, are known to exist in the state; viz. magnetic iron, limonite and spathic-iron. Native (or pure) iron has indeed been found in a single instance on Canaan mountain, but in a quantity too small to create any other than scientific interest; and this was very deeply excited from its being one of the best authenticated instances of terrestrial native iron known.

Magnetic Iron.—This valuable ore, so abundant in some sections of the United States and in the north of Europe, and which is so well characterized by its action on the magnet, its high specific gravity and its black color, was reasonably to have been looked for in the extended gneiss formation of the State, since this rock is its usual repository elsewhere. Thus far, however, but few localities of it have been discovered. One of the most important of these is a newly opened bed at New Preston, on land owned by Alvan Brown, and situated three quarters of a mile southwest from the iron-furnace at the outlet of Waramaug pond. The ore is included in gneiss and occurs on a low mountain about one hundred and fifty feet above its base. The position of the bed is nearly vertical, its sides being well defined, and distant four feet. Such is its facility of working, that the ore is raised at an expense below fifty cents the ton. Some fears are entertained respecting its value from the circumstance, that it is more or less penerated by iron-pyrites (542*b*).

But as the pyrites is very decomposable by atmospheric action (333*b*), it is to be hoped that the process of roasting, together with simple exposure to the weather for a short time, will so far free it from sulphur as to permit its use advantageously, at least when mingled with the ordinary ore of the vicinity. No doubt can be entertained concerning the abundance of the ore; and preparations were making last summer for a full trial of its value. About thirty tons of the ore from this bed are said to have been successfully smelted twenty years ago in the forges of Litchfield and those of the immediate neighborhood.

A bed of excellent ore (538*b*) has long been known to exist in the southeastern part of Sharon on Buck's mountain, which is situated directly on the Housatonic river. The ore is half a mile distant from the river, and at least two hundred feet above the surface of the stream. It is said to have been traced in an uniform direction for the distance of a mile. Where the excavations have been made, it has frequently shown a width of eighteen inches or two feet, though it appears often to contract within much narrower limits. The ore is entirely free from iron-pyrites, and even from earthy substances. Fifty tons of it were raised half a century ago, and successfully employed in forges; and a much larger quantity from the same mine only eight years since, commanded the price of five dollars per ton. Still the working of the bed is for the present abandoned as unprofitable, although the want of success in the last attempt is attributed by some to the fact that an injudicious part of the bed was selected for the experiment.

Another bed of this ore has been found in Reading, on land owned by M. Gregory. It is situated near the boundaries of Wilton and Ridgefield, and within a few rods of the Sugar-Hollow turnpike. The ore is disseminated in irregular, discontinuous seams, from half an inch to two inches wide, through a bed of quartz ten or fifteen feet thick, included in a ledge of gneiss. With it, is associated in the same bed, garnet, tourmaline and iron-pyrites. The rocks presenting in this place an almost perpendicular face of twenty five feet, it is easy to inspect the situation of the ore, which has the appearance of being confined to a portion of the bed, not above four feet in width. But little labor has been expended upon the development of the ore; consequently it is difficult to form an opinion of its ex-

tent. It (544) is more finely granular than that of New Preston or Sharon, and is slightly blended up with chlorite.

An ore nearly identical in appearance with that just described, it being both fine granular and intermingled with chlorite (543), occurs in Newtown, on a wooded swell of land, a little east of JUDSON'S quarry. It is found disseminated through seams of quartz in gneiss. No mass of the ore was noticed above two inches in diameter, though seams of pure chlorite (375) were common of much greater thickness. At one spot indeed, this mineral was several feet in thickness. As the rock is much concealed by soil, it will not be easy to settle the question whether or not, a profitable bed of ore does here exist.

A more encouraging prospect for obtaining a supply of magnetic iron is afforded in the northeastern corner of Winchester, where a thin stratum of it was discovered upwards of forty years ago. It is contained in gneiss, and like the two last embraces chlorite (542). But little labor has been expended with a view to lay it open. Its width appears to be about one foot. It is well situated in point of elevation for exploration, and from its contiguity to important iron works, merits more attention than it has hitherto received.

Traces of magnetic iron have been observed at other places in the gneissoid region of northwestern Connecticut, and occurring as they all do under conditions so analogous to those of the Highland beds, we are fully authorized to regard some of them as belonging to the same general gneiss formation, the direction of which scarcely varies from northeast to southwest. This coincidence leads us to hope that more extended researches will at no distant period result in the discovery of good workable beds of this invaluable ore.

The southwestern section of the State also furnishes indications of the species now under consideration, though under circumstances quite different from those above mentioned. The sand of the seaboard from New Haven quite to Stonington Point, and even beyond, upon the Rhode Island coast, frequently contains magnetic iron in the state of iron-sand (540). A forge in Voluntown has derived considerable quantities of ore from this source.* The origin of this

* The magnetic iron-sand might be purified from the foreign materials with which it is much blended, by means of the magnetic separating machine invented by

sand is apparent in the granite bordering on the Sound, especially in the flesh-red varieties of Stonington and Groton (46*b*). The most remarkable occurrence of the ore *in place*, however, is on SELDON'S point, in Hadlyme. It is here found in several spots disseminated through granite in beds and nests, sometimes of several square yards in superficial extent, and forming one quarter or even one third part of the rock. In structure, it is highly crystalline, the individuals being large and apparently playing the part of feldspar in the composition of the rock (541*b*). The ledges are sufficiently elevated to facilitate the raising of the ore, and so near the Connecticut as to render its transportation to some suitable place for reduction highly convenient. Under these circumstances, it seems surprising that no trial has hitherto been made with a view to develop the extent and value of this deposit.

The same variety of ore is common, though less abundant, in the granite of Walkley hill, half a mile north of the court house in Haddam (537*y*) and in North Madison, two and a half miles west of the meeting house on land of Col. BENTON (538). At both of these places, the ore is more frequently in distinct crystals than at Hadlyme.

Limonite.—This species includes all the ores which have heretofore afforded iron to commerce in this State, if we except the unimportant quantity derived from the magnetic iron-sand above mentioned. It presents a number of mineralogical varieties, depending on diversities in mechanical composition, the intermixture of foreign species, and rarely of organic impurities. Among these varieties the following may be enumerated as the most important: *fibrous brown hematite* (547, 548), *compact hematite* (552), *ochrey brown iron-ore* (553), and *bog iron-ore* (553, 554).

Fibrous brown hematite consists of 82 peroxide of iron,* 14 water, 2 oxide of manganese and 1 silica, in the hundred parts, while bog iron-ore contains from 40 to 50 p. c. of peroxide of iron, the other

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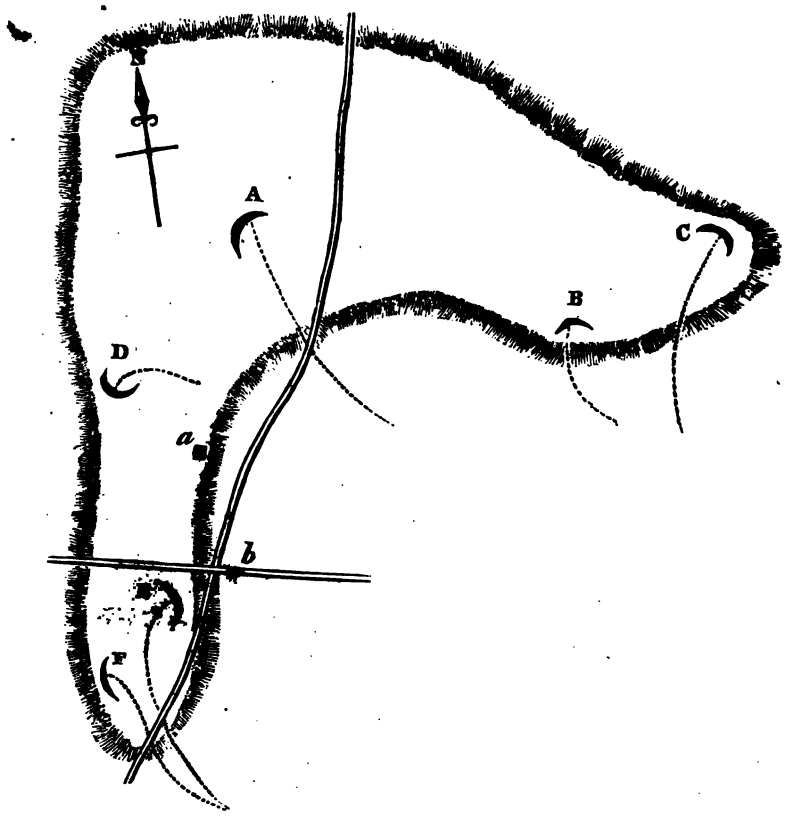
SAMUEL BROWNING, or possibly still better by galvanic magnets, which have already been constructed with power to raise a ton's weight. As the power of the latter instrument may be instantaneously suspended and renewed, it is likely that it would possess decided advantages over the magnetic separating machine.

* Peroxide of iron contains 70 p. c. metallic iron.

ingredients being silica, alumina, water and oxide of manganese, with frequent traces of phosphoric acid.

The fibrous brown hematite, compact hematite, and the ochrey mixtures of the two, are generally confined to primitive rocks, as gneiss and mica-slate. They afford materials for very large iron-works in many countries, and are universally regarded as the best ores for yielding a malleable iron, and for being easily converted into steel. Although these ores (which may be referred to, under the general name of hematite) are confined to a limited district of the State, they nevertheless appear to constitute its richest metallic resource. The towns in which they exist are Salisbury, Sharon, and Kent; and the principal deposits hitherto explored, are those of the "Ore-hill," Salisbury,—the Indian pond ore-bed, Sharon,—and the Kent ore-bed. The two first form beds in mica-slate; the last in a micaceous gneiss and quartz-rock. At Sharon and Salisbury, the ore is disposed in vast beds with a stratification every where obvious, and perfectly conformable to that of the adjoining mica-slate. It is moreover, free from secondary aggregates. At Kent on the contrary, the order of arrangement is less visible in the bed, which at first view appears to be a confused accumulation of broken, decomposing (and in some instances re-cemented) rock, at the foot of a high ledge.

The Ore-hill mine of Salisbury is by far the most important of these deposits. It is situated about two miles west of the Furnace-pond and covers an area of several acres, forming the southeastern slope of a slight elevation of land. It is worked like a quarry, open to the sky. The entire surface of the slope is destitute of vegetation, and every where excavated by diggings and pits, the former being slight are called by the workmen, "wood-chuck holes." The principal pits are six in number. These are carried forward on a level into the hill at various depths, from twenty to thirty-five feet, below its general surface. The annexed diagram will give an idea of their relative situation.



A, big drain-pit. B, mammoth-pit. C, cornstalk-pit. D, Blodget & Kelsey's pit. E, brook-pit. F, Walker's pit. *a*, Agent's office. *b*, road to Furnace-pond; dotted lines show the direction of the drains from the pits.

Each pit is explored by a separate company of individuals, who are allowed by the proprietors of the ore-bed, the exclusive right of raising ore within certain limits. The pit-owners again grant permission on their own terms to others who wish to engage in the small surface diggings, which are never carried so deep as to require the construction of drains. The brook and big drain-pits are the largest: the latter raised one thousand tons of ore between April and July, of the last season. One dollar and three quarters is paid to the pit-men for raising the ore. The duty exacted by the owners of the mine is one dollar and a quarter; and the expense of carting

is one shilling per mile, making the entire cost of the ore to the furnaces between four and five dollars the ton. The average amount annually raised from this bed during the last forty years, has been five thousand tons. Nor does it appear that the deposit has been dug through excepting near its western boundary, where the excavations have been made somewhat obliquely across the layers of the bed; its depth in the direction of the strata, it may be presumed, is very great, and no satisfactory evidence could be procured, that its bottom has ever in a single instance been obtained. At the present rate of working the bed, no material advance in the price of raising the ore is anticipated; and ultimately, when the upper levels are exhausted, the introduction of the steam engine with the usual machinery of deep mines, by the advantages they will afford over the present mode of working, will still be able to supply the furnaces without any increase of charge.

The principal furnaces supplied with the ore of this bed are the following: 1. Chapin's furnace, situated in the north part of Salisbury, 2. Salisbury Iron Company's furnace, at Mount Riga, 3. Canfield, Sterling & Co., on the Housatonick, 4. Holly & Co., at Limerock, in the eastern part of Salisbury, 5. Two furnaces in the western part of Cornwall, 6. Ancram furnace, in New York. The ore is reduced at these places in high furnaces, and yields on an average from forty to fifty per cent of pig-iron. This is principally converted into bar-iron at the furnaces where produced, or at the forges in Winsted and Canaan, and is there manufactured into bar-iron for musket and rifle-barrels, and for common uses for the blacksmith; anchors, axletrees, iron-bars and tires for wheels, irons for grist and saw-mills, shafts for steam-engines and manufactories of all kinds; large screws for clothiers, paper-makers, and for pressing bales of cotton and hay.*

The Indian pond ore-bed is situated on the east side of Indian pond, and directly at the base of a high ridge of mica-slate. Its

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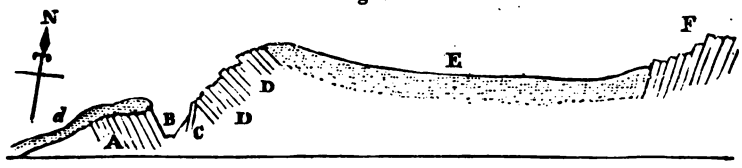
* The best Salisbury iron has obtained a decided preference over all other iron, either foreign or domestic, for the construction of musket and rifle-barrels. Its consumption for this purpose was several years ago as follows: public armory at Springfield, (Mass.,) one hundred and twenty tons, public armory at Harper's ferry, (Va.,) one hundred tons, gun factories at Whitneyville and Middletown, (Ct.,) and at Pittsfield and Millbury, (Mass.,) from forty to fifty tons each. The expense of transportation from Salisbury to the Hudson river is five dollars per ton.

distance from the pond is about sixty rods, and its elevation above it forty or fifty feet. The ore forms a distinctly stratified mass, whose layers correspond in direction and dip to those of the adjoining rock, inclining 45° to the east. A considerable accumulation of diluvium is piled up against the bed. The ore is less abundant than at Salisbury. Frequently the strata are too lean to justify exploration, in which case the workmen omit to remove such portions, and follow the ore in directions where it is richer. About two thousand tons of ore are annually raised from this deposit, at an expense of one dollar and a half per ton. It is principally carried to a furnace in Sharon, owned by Messrs. Brinsmade, Wolcott & Smith, and distant two and a half miles from the bed. The iron yielded by this ore is less malleable than that of Salisbury, and is principally used for castings.

The Kent bed was formerly considered as a very important deposit of ore. It supplied several extensive forge-establishments for a great number of years with ore of an excellent quality; but partly in consequence of the unskillful and improvident manner in which the original workings were conducted, and partly from the limited extent and peculiar situation of the bed, it has now sunk into almost total neglect. It is situated on the western declivity of a low mountain, near its base. In length the mountain is about three miles, and in height two hundred feet. Its length corresponds with the edges of stratification in the vicinity, which do not differ essentially from north by east. Annexed is a cross section of the western slope of the elevation, passing directly across the ore-bed.

Fig. 1.

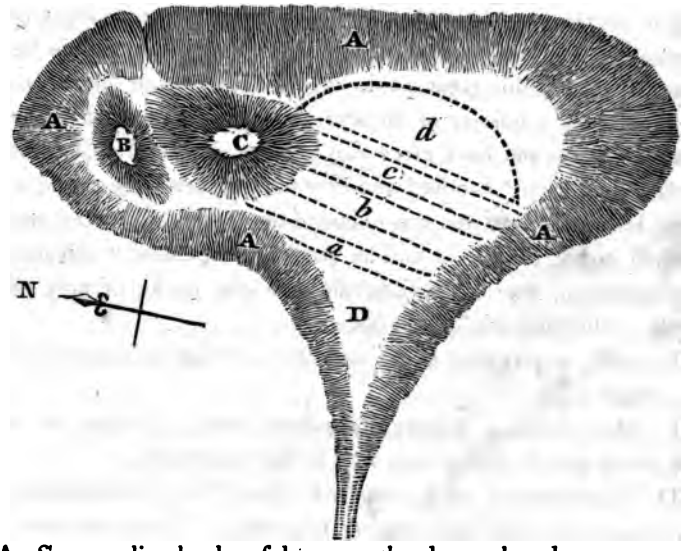


A. Decomposed micaceous gneiss (97*b*), called by the workmen "gray fuller's earth." Its dip is between 60 and 80° east. It is covered with a thin covering of diluvium, *d*.

B. Ore-bed. The mine is at present in such an uncleared and neglected condition as completely to conceal the position of the bed. Considerable information however, was derived from several intelli-

gent miners who were formerly engaged in its exploration. From their statements, it appears that the ore is situated in a number of nearly parallel veins (beds), whose direction and dip is nearly coincident with that of the gray fuller's earth A. Between the beds, several feet of gray fuller's earth are interposed. They state moreover that the fuller's earth where in contact with the bed of ore possesses an indurated texture, and has consequently received from them the name of "shell" (98*b*). A ground-plat view will render intelligible the direction of these beds, as well as the general figure of the pit which has been formed in excavating the mine.

X Fig. 2.



A. Surrounding banks of loose earth, clay and rock.

B and C. Oval elevations, or cones, of loose earthy materials.

D. Bed of stream (generally dry) over which the water flows that carries out the earth and stone from the bed, and in which the ore is washed. The water employed for this purpose is collected in a depression, E, (fig. 1) just above the top of the bed, and is let on at X, where a dam and gate are situated. It is only during a short season in the spring and autumn, that they have the command of water adequate to the operation. During a full supply, the mine is inundated forty or fifty times in a day. By this means the loose materials, including masses of rock above a foot in diameter, are swept through the whole length of the drain for a distance of thirty rods into the low

ground. The height of the inclined plane forming the bed of the stream is about sixty feet.

a, Drain-vein. *b*, Chocolate-vein. *c*, Blue swamp-vein. *d*, Anvil-ledge.

The chocolate-vein was worked from seventy to one hundred feet in length, and about twelve in width. The drain-vein had nearly the same width. At present, all the beds indicated in the sketch, with the exception of the anvil-ledge, are covered up by the rubbish which has washed down from the banks. Indeed, the working at this place has almost wholly ceased, from the depth at which the ore lies and the danger apprehended from the sliding down of the eastern wall, which overhangs the bed in a frightful manner, presenting a nearly vertical front of loose, shelly materials, sixty or seventy feet in height. Several slips in this great bank have actually taken place, during which at least a quarter of an acre of rock and earth have been in motion at once, and have given rise to large sinks and chasms on the surface. But one hundred and fifty tons of ore were raised at this place last year; and this was obtained by picking up pieces that had washed out of the banks and by partial adits, called "burrows" by the workmen, carried horizontally into the banks of gray fuller's earth, in the direction of the beds.

In farther explanation of the bed, the following references to fig. 1 are added:

C. Decomposing, quartzy mica-slate (180). It dips 80° west, and forms part of the eastern wall to the excavation.

D. An alternation of quartz-rock (like 180*b*), decomposing, micaceous gneiss (96) and quartzy mica-slate. They rest their basseting edges on C, and dip 20° east.

E. Wet alluvium; during part of the year a shallow pond. It extends back about forty rods to the ledge F.

F. Gneiss, thick granitic, and occasionally hornblendic. It is nearly vertical, dipping 80 to 85° west.

At present the workmen are directing their attention to a more recent opening, situated seventy or eighty rods north of the old mine, on the same slope and at the same elevation above the valley. It has been worked more or less for a period of thirty years. Until lately, the ore was obtained exclusively by burrows; but they have now formed a deep drain, open to the air as at the old bed, and from the sides of this drain they carry in burrows, where the workmen

operate to advantage during the winter. In this way, one hundred and fifty tons were obtained during the last year by two hands. The ore sells for three dollars and a quarter per ton, at the mine; one third of which sum is allowed the workmen, together with some privileges connected with the farm on which the mine is situated.

The Kent ore-bed cannot with any degree of propriety be considered as exhausted. The whole distance between the north excavation and the old bed is probably occupied by ore, while the beds in no instance have as yet been dug out in the direction of their stratification. From their relation to the including strata A and C (fig. 1), it would appear indeed, that at a certain depth, they must grow very thin and finally perhaps wedge out, altogether. But from the distance of A and C, it is obvious that this cannot occur short of a very great depth. To recommence the work with profit however, will undoubtedly demand a heavy expenditure, though it scarcely admits of a doubt that the proprietors would in the end experience a full and satisfactory remuneration.*

Several minor deposits of limonite require a brief notice, before concluding this account of the present species of iron-ore. The most important of these is known as Chatfield's bed. It is situated a quarter of a mile southeast from Ore-hill and at a lower level, by about one hundred feet. Indeed, the natural drain from Ore-hill passes directly by Chatfield's bed. The excavation here made is not far from ten rods in length, by two or three rods in width and from twenty five to thirty feet deep. Its direction is nearly north and south. The bed, together with the adjoining rock, dips 50° to the east. In excavating a drain for a considerable distance through the mica-slate rock forming the eastern side of the pit, it was found that the rock was hard until within ten feet of the bed, where it became more or less soft through decomposition. The bed at the sur-

* Much of the ore afforded by the anvil ledge, some of which is still accessible, is the variety called by the furnace-men "frost-ore." It is an iron-breccia, consisting of fragments of quartz and ferruginous jasper, cemented together by limonite, the aggregate being filled with cavities lined more or less with minute crystals of transparent quartz (487). Several unsuccessful attempts have been made to reduce it in furnaces, but it has only yielded an inferior kind of cast-iron. A different mode of treatment in respect to the kind and quantity of flux, might be attended with better results. The subject justly merits attention, as thousands of tons of this variety might be raised at a trifling expense.

face had a breadth of two or three rods, but has continued to close up as it goes down, until at the south end of the pit where the working is now going forward, it has a thickness of but ten feet. At this point, moreover, it has altered its direction, and instead of falling off to the east, has assumed a southerly dip and appears likely to wheel round still farther and finally to run into an old pit, twenty rods long, which was worked forty years ago. The stratification of that pit was said to have been southwesterly in its lie. And as the direction of the excavation points directly to the Ore-hill, it would seem to favor the idea of a communication between the two deposits. It would be interesting to ascertain whether this connexion does actually exist. The sinking of a few pits at various spots in the line of direction would easily settle the question.

Seven hands are employed at Chatfield's bed. In 1835, eight hundred tons of ore were raised, and a much larger quantity in 1836. It is carried to the furnaces in Canaan and Cornwall, and is said to yield an iron scarcely different from that of the Ore-hill. One fact however, is noticeable with respect to the ore at this place, which serves to distinguish it from that of Ore-hill. The fibrous varieties are closer and often impalpable in their texture; a circumstance which may possibly be attributed to the lower level and moister situation of Chatfield's bed.*

Another bed still wrought to a small extent in Salisbury, is Davis' ore-bed, situated two and a half miles northeast of Ore-hill. It occurs along the sides of a small stream which runs through a slight depression or valley, down a gentle slope of ground which falls off towards the east. The gray fuller's earth is abundant in the vicinity, and considerable ore has been dug by sinking pits into it, at numerous places. It is difficult however to drain the excavations, and the ore lying considerably below the surface, and being raised in small pieces and much intermingled with clay, requires to go through the process of washing. At present they are raising ore from an excavation twenty five rods in an easterly direction from old pond-bed, a pit that twenty years ago yielded three thousand tons of excellent ore. Four hands raised one hundred and fifty tons in one

* An opening for ore was made a few years ago, two hundred rods north of Chatfield's, but the bed was found to be too thin to make its exploration an object.

month during the last summer. They receive one dollar and sixty-two cents per ton for the ore, from the proprietors of the bed. The ore is carried to Mount Riga. It yields iron of excellent quality, and is smelted with much less fuel than that of Ore-hill.

Two extensive deposits of hematite exist in the north part of Salisbury, distant from each other about a mile; one is called Scóvil's, and the other Chapin's bed. They are so situated however as to render the draining of them difficult. The ore is said to be abundant, and is extremely compact in its texture (550*b*). All attempts however, to obtain from it a good iron have thus far failed; and the beds have consequently been abandoned for upwards of eight years. The product of these ores, when smelted, was almost wholly devoted to kentledge. The complaint has been made by some of the workmen, that the ore is too rich; and it has been suggested again by others, that it is in consequence of the presence of oxide of manganese. But it seems much more reasonable to attribute the partial success in smelting this ore to its compact texture, for it does not appear that the process of roasting has in the least been modified in consequence of this structure. The ore has accordingly been introduced into the furnace in an unprepared state. Its volatile ingredients, water, sulphur and arsenic (perhaps) have not been dissipated; in addition to which its texture has not become sufficiently porous to allow of the free access of the gaseous combustible matter for its reduction, as a consequence of which instead of passing directly to the metallic state, a large part of it unites as protoxide of iron with the silica and forms an irreducible slag, from which it is difficult wholly to separate the portions that have suffered reduction. Some sulphur also, from defective roasting, is present to vitiate the result. If the difficulty in the present case is referable to the source here supposed, the remedy is obvious. Instead of roasting the ore in large open heaps, it is only necessary to heat it in furnaces similar to those employed for burning lime, (called perpetual kilns,) where the fire is constantly kept up, and portions of the charge from time to time withdrawn. Such furnaces for roasting iron-ores are common in Germany. They are constructed of brick, and have a cylindrical shape, with an elevation of seventeen feet. Three openings with grates are placed equidistant, near the bottom for introducing the coal, between which are three others, situated on a level with the

ground, for pulling out the ore. A small cast-iron cone is placed at the bottom of the furnace, for the purpose of keeping the ore properly accumulated against the grates, where the heat is the strongest.

Several other promising indications of hematite are found in the towns of Salisbury, Sharon, Cornwall, Kent and New Milford, but no beds, excepting those already mentioned, have yet assumed sufficient importance to be treated of in this report. Whenever the enterprise of their proprietors, or of others shall cause them to be thoroughly explored, the sources of workable iron-ore to the State will be augmented to a very important degree. There certainly does not appear to be the smallest ground for apprehension, that a decline of this resource is likely to occur for many generations to come, at least so far as a supply of ore is concerned. A slight depression in the iron-interest has been experienced within a few years, which is attributed by the proprietors of furnaces to the high price of ore and of charcoal. The duty on the ore of Salisbury (Orehill) was originally but forty-two cents the ton; but it has steadily advanced, until within the last fifteen years, it has stood at one dollar and a quarter. Charcoal has also increased in value fifteen or twenty per cent. These advances will no doubt continue to be felt, unless met by corresponding exertions to avail of higher economy and skill in the fabrication of cast-iron. Important ameliorations are capable of being introduced, not only in the picking and roasting of ores, the preparation of charcoal, the selection and apportioning of fluxes, but still more in the admission of heated air in the blast.*

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* As no furnaces in the State have attended to this last mentioned improvement, it is to be presumed that the nature of the invention is not fully understood by proprietors of iron-works. A few general remarks respecting the subject may not therefore, be inappropriate to this report.

In the fabrication of cast-iron it must be obvious, that a certain temperature is necessary to secure the favorable working of the furnace. If this is not reached, all the stock added, is (in the language of the furnace-men) "cut to pieces" without any reduction of the metal. The manner in which the hot blast secures the heat required, is at once understood if we reflect upon the ascertained fact, that in a furnace whose charges of stock amount to two tons per hour, the weight of air driven in, is six tons for the same time. The difference between the admission of this prodigious weight of air at 50° and 600° is most apparent, especially when it is considered that it enters the hottest part of the furnace. In both cases, the effect it produces to support combustion is the same; in the latter however, it does not rob the combustion of the heat it produces. But before quoting the verification of the ra-

The following is an approximation to the annual yield of furnaces in cast-iron in this section of the State:—

	The ore from N. Y.	The ore from Conn.
Housatonic manufacturing co.,	500 tons.	
Macedonia furnace co.,	850 "	
Kent furnace co.,	600 "	
Sharon valley-furnace,		800 tons.
Raumaug iron co.,	500 "	
Chapinville,		400 "
Canfield & Robbins,		400 "
Cornwall iron co.,		500 "
Cornwall-bridge iron co.,		1000 "
Limerock furnace,		400 "
Mt. Riga,		500 "
	2450 "	4000 "

tionale given and which experience has furnished, it is proper to allude to the method by which the air is heated and to state how it is forced into the furnace. A number of arrangements have been adopted in Scotland for heating the air, but no one in particular seems hitherto to have proved itself superior to the rest. In general, the method may be described to consist, in maintaining at a red heat, the cast-iron tubes through which the air from the blowing apparatus to the furnace is conveyed. But as the temperature of the furnace near the nozzles becomes so much elevated, it is necessary in order to prevent the melting of the cast-iron lining to employ the water-tweer; which consists of an iron-lining, cast hollow instead of solid, so as to contain water within, which is admitted by means of one pipe and allowed to escape by another as it becomes heated. It thus becomes practicable to lute up the space between the blowpipe nozzle and the tweers, whereby all loss of air is prevented, and the bellowing noise formerly produced completely suppressed.

To exhibit in a satisfactory point of view the operation of this arrangement, the results obtained at the Clyde iron-works in Scotland may be instanced.

" During the first six months of the year 1833, when all these changes had been fully brought into operation, one ton of cast-iron was made by means of 2 tons 5¼ cwt. of coal, which had not previously to be converted into coke. Adding to this 8 cwt. of coal for heating, we have 2 tons 13¼ cwt. of coal required to make a ton of iron; whereas in 1829, when the cold blast was in operation, 8 tons 1¼ cwt. of coal had to be used. This being almost exactly three times as much, we have from the change of the cold blast to the hot, combined with the use of coal instead of coke, *three times as much iron made from any given weight of splint coal.*

" During the three successive periods that have been specified, the same blowing apparatus was in use; and not the least remarkable effect of Mr. NEILSON's invention has been the increased efficacy of a given quantity of air in the production of iron. The furnaces of Clyde iron-works, which were at first three, have been in-

In order to do full justice however, to the yield of our mines, it requires to be mentioned, that about nine hundred tons of ore go annually from the Salisbury Ore-hill to the Ancram iron-works in the state of New York, and three hundred tons of Kent ore are consumed by the forges in the vicinity of the ore-bed. We shall be justified therefore, in estimating the annual product in cast-iron from the hematite ores of the State at four thousand five hundred tons.

The bog iron-ore has from an early period, attracted considerable attention in the central and eastern part of the State. It was formerly dug and smelted in situations where it has long since ceased to be worked, the beds then known having been exhausted and the ore not since reproduced. This was the case in North Haven and Branford, and some other towns bordering the Sound in the south-

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creased to four, and the blast-machinery being still the same, the following were the successive weekly products of iron during the periods already named, and the successive weekly consumpt of fuel put in the furnace, apart from what was used in heating the blast:—

					Tons.			Tons.			Tons.	
In	1829,	from	3	furnaces,	111	Iron,	from	403	Coke,	from	888	Coal.
	1830,	"	3	"	162	"	"	376	"	"	836	"
	1833,	"	4	"	245	"	"			"	554	"

"Comparing the product of 1829 with the product of 1833, it will be observed that the blast, in consequence of being heated, has reduced more than double the quantity of iron. The fuel consumed in these two periods, we cannot compare; since in the former, coke was burned and in the latter, coal. But on comparing the consumpt of coke in the years 1829 and 1830, we find that although the product of iron in the latter period was increased, yet the consumpt of coke was rather diminished. Hence the increased efficacy of the blast appears to be not greater than was to be expected, from the diminished fuel that had become necessary to smelt a given quantity of iron. On the whole then, the application of the hot blast has caused the same fuel to reduce three times as much iron as before, and the same blast twice as much as before. The proportion of the flux required to reduce a given weight of the ore has also been diminished."

"In Scotland, Mr. NEILSON's invention has been extensively applied to the making of cast-iron, insomuch that there is only one Scotch iron-work where the invention is not in use; and in that work, apparatus is under construction to put the invention into operation."—(*On the application of the Hot Blast, in the manufacture of Cast Iron, by* THOMAS CLARK, M. D., Professor of Chemistry in Marishal College, Aberdeen. Transactions of the Royal Society of Edinburgh, Vol. xiii, p. 373.) For additional details respecting this improvement, see a treatise "on the use of hot air in the iron-works of England and Scotland, translated from a report made to the Director General of mines in France, by M. DUFRENOY, in 1834. London. Murray. 1836.

eastern part of the State. The region however, that now affords supplies to two considerable furnaces, one in Stafford, the other in Hebron, may be defined as consisting of all that part of the State, lying to the north and northeast of Colchester. The parent rock of this ore is a pyritiferous gneiss, which is an extensive formation in the northern part of New London, Tolland, and Windham counties (96*b*), and even spreads over much of the western and central part of the county of Worcester, in Massachusetts. The towns in which it appears to have been the most abundantly developed are the following: Colchester, Hebron, Tolland, Willington, Westford (in Ashford), Stafford, Union, and Woodstock. The deposits present obvious differences, attributable to the periods in which they were formed. The ore at present dug near the village of Colchester (554), appears long since to have ceased in its accumulation, and bears marks of having been chiefly deposited anterior to vegetable deposits. It forms a thin stratum reposing directly upon the diluvium, and appears to be almost wholly wanting in vegetable reliquiæ. Above it, is a black mould or soil of one or two feet in thickness. The beds in Tolland, Woodstock, and other places, often embrace vegetable remains, and the depositions in some situations are said to undergo a renewal in ten or fifteen years. A variety found one mile north of Black pond in Woodstock, presents surfaces when it has been exposed to the weather, having a fine siliceous coating (556) in the form of threads, and apparently due to the siliceous skeletons of sedge grass, with which family of plants the adjacent swamp abounds. The ore is throughout traversed by these filaments, which are rendered apparent by exposure to the weather. One pit at this place yielded one hundred and fifty tons of ore. The proprietor obtains one dollar per ton for the ore as it lies in the bed. One hand is able to dig six tons in a day. It is more usual however, for the owners of the furnaces to contract for entire beds, rather than to purchase the ore by the ton delivered at their works. The most accessible beds in Stafford have been exhausted; but the towns of Union, Woodstock, Willington, and Tolland, will be able to furnish ore for a long period to come. The iron-works at Stafford produce three hundred and fifty tons of castings, yearly. A part of the ore employed however, comes from the neighboring towns of Massachusetts. The newly erected furnace in

Hebron, is at present chiefly supplied with ore from Colchester. Considering the wide extent of the ferruginous gneiss, and the abundant indication of iron in the color of the soil and the rusty pellicles on the surface of springs, we can with difficulty apprehend the speedy failure of this convenient mineral resource to the inhabitants of the above specified region.

Spathic Iron.—This invaluable ore, of which Connecticut appears to possess the most remarkable mine in the United States, will justify a more particular and detailed notice in this report from the fact, that it has been overlooked as an iron-ore with us nearly to the present time, and still remains in a neglected state. The mine was discovered at a very early period in the history of the State; and the abundance and peculiar properties of the ore excited a high degree of curiosity and expectation. Numerous attempts were made to work it as a silver-mine, and immense sums expended without exciting even a suspicion of its value for iron.

Spathic iron is one of the most disguised of all the ores of iron, possessed of economical value. Its high specific gravity, added to the development of iron-rust occasioned by exposure to the weather, are the only properties by which its ferruginous character is generally detected. Its name of spathic (or sparry) iron was bestowed in allusion to its brilliant and easily effected cleavages in three directions, and which result in rhombic fragments of constant dimensions. Its hardness is greater than that of calcareous spar; and its color when freshly taken from its repositories is a light yellowish gray (357), which passes however by exposure to the air, to a reddish brown (358). It is composed of protoxide of iron from 57 to 60 p. c., carbonic acid 34 to 36 p. c., with a proportion of manganese from 0·5 to 1·5, and about the same quantity of lime and magnesia. The lime and magnesia however, are liable to slight variations in their proportions.

The spathic iron-mine in question occurs in a mountain about three hundred and fifty feet in height, situated on the western bank of Shepaug river in Roxbury, about four miles above its junction with the Housatonic. The mountain is known in the vicinity by the name of Mine-hill. The rock of which it is composed is, for the most part, concealed by a soil supporting a fine growth of hard wood. Wherever the rock makes its appearance however, it exhibits a re-

markable uniformity in character and arrangement. The direction of the strata is nearly N. E. and S. W., with a dip of 25 or 30° to the northwest. The ore occupies a perpendicular vein from six to eight feet in width, cutting directly across the strata; and has been detected at numerous places from the base of the hill near the banks of the river, quite to its summit, a distance of above half a mile.* The course and width of the vein wherever exposed, appear uniform. The vein-stone, or gangue of the ore, is white quartz, which frequently preponderates in bulk over the ore. No other substances deserve to be mentioned as entering into the composition of this very remarkable vein,—minute portions of iron-pyrites, yellow copper-pyrites, galena and blende, being the only foreign substances present, and as these occur principally near the summit where the most extensive explorations were made for silver, it is altogether likely that the blende was the principal object of search.†

Whoever examines this vein must be convinced of the abundance of the ore, as well as struck with the facility of its situation for be-

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* Two other quartz-veins, one north and the other south of this vein, have been observed. The most southerly vein has been examined in two places and discovers traces of spathic iron: it may yield when thoroughly opened, a sufficient quantity to justify exploration. It is situated about one hundred rods from the great vein.

† The first digging at this place was made about the middle of the last century by Hurlbut & Hawley, but the history of their operations is nearly lost. The second company, organized by the Messrs. Bronsons (brothers) near the year 1760, prosecuted the enterprise with much spirit. They sunk a shaft into the vein near the top of the mountain, one hundred and seventy-five feet deep, besides carrying down another of considerable depth for the ventilation of the first. The working was conducted under the direction of a German goldsmith, who carried on his processes of pretended separation and refining with great secrecy. It is said, that he produced occasionally small quantities of silver, which kept alive the hopes of his employers. Thus the undertaking went forward for several years, until the means of the company were wholly exhausted. The result of this experiment might in all probability have put the working of the mine for silver completely at rest, except for a circumstance which occurred connected with the departure of the German. When he left the mountain, he was assisted by a slave in removing a number of very heavy boxes, one of which accidentally falling to the ground, burst open and revealed to the eyes of the negro a quantity of bars, which he described as having the appearance of silver. The agent was now suspected to have carried on the working of the mine fraudulently, and to have caused its products to be surreptitiously conveyed out of the country for his private advantage; consequently, the mine again acquired the character of a valuable deposit of silver. A new company was organized in the city of New York, who took a lease of the property for forty-three

ing wrought. The expense to be incurred in raising it from its repository and in its delivery upon the banks of the Shepaug, where the necessary water-power is afforded for carrying on extensive iron-works, must be comparatively trifling; while an abundant supply of hard wood is at hand for fuel, and a land-carriage of four miles would connect the works with the navigable waters of the Housatonic.

The spathic iron being an ore of such unusual appearance, and no where wrought in the United States, it is not surprising that the remarkable deposit here alluded to, has so long been treated with neglect. Public attention however, can in no way perhaps be better excited towards so valuable a resource than by making known its extensive use in other countries, and by pointing out a few of the leading facts connected with its conversion into steel. It furnishes almost exclusively the well known German steel, so largely manufactured in the Austrian dominions. Thus in the Tyrol, the annual produce is two thousand quintals, and in Carinthia seventy thousand.

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years. They commenced operations on a much wider scale, and have left behind the proofs of a very heavy expenditure. The excavations made by this company, exhibit more science in the working of mines. They descended the mountain towards the river in the direction of the vein, removing at intervals the accumulations of soil and loose rocks which conceal it throughout its whole distance, until they reached half way to the base of the mountain, when they commenced carrying in a level having the full width of the vein, and which is said to have been prosecuted to the distance of twenty rods. The result of this enterprise was equally unpropitious with the former one, though not sufficiently discouraging to lead to the final abandonment of the project. Still another company was formed, consisting chiefly of persons living in Goshen, who recommenced the diggings at the top of the mountain, and persevered in the undertaking until the failure of several of the stockholders compelled them to relinquish it. The last working of the mine for silver was by Mr. BACON, an extensive landholder in that neighborhood. It finally began to attract attention as an iron-mine, and considerable quantities of the ore raised by the different companies were carried to Kent, and there reduced along with the hematite of that place, with which it is said to have formed a very tough and excellent iron. An unskillful attempt was afterwards made to reduce the spathic iron by itself in a furnace at no great distance from the mine, which proving unsuccessful, no farther notice has been taken of the ore. The present proprietor of this mine, Mr. DAVID J. STILES of Southbury, procured a sample of pig-iron obtained during the last mentioned trial, and caused it to be forged into steel under his own inspection, by an experienced iron-master in Salisbury. The operation was attended with great facility; and a variety of cutting instruments were manufactured from the steel, all of which proved of excellent quality.

In Stiria, at Vordernberg, fourteen high furnaces are in constant use in reducing this ore, and four others at Eisenertz. They are supplied from a mountain two thousand feet in height, composed entirely of spathic iron. The ore is conveyed to the furnaces on rail-ways, some of which are from three to five leagues in length. The annual produce of soft iron and steel from this vicinity, is three hundred and fifty thousand quintals. The cast-iron is afforded at the low price of from one dollar and a quarter to one dollar and a half per quintal, and the steel at four dollars per quintal. The steel is fabricated into sythes and other articles of coarse cutlery, and is exported in bars. Twelve hundred men are employed in the steel-works of the two last mentioned places. Spathic iron is also largely explored at Allevard near Grenoble in France, and in various other places in Europe.

The following is an outline of the most approved method at present practiced in the management of this ore. It is treated in high furnaces like hematite, without any other flux than the quartz with which it is generally found associated. The cast-iron which it yields, is remarkable for its white color, and lamellar or foliated texture. It is refined or converted into steel in forges, similar in many respects to those used for making bar-iron. The hearth or crucible for the reception of the fuel and the pig-iron, is formed by several cast-iron plates, having a bottom or sole, of refractory sandstone. The chimney is twenty-seven feet in elevation from the level of the ground, with a cavity twenty-eight inches by twenty-two. The blowing apparatus is pyramidal in form, and seven feet in length. The diameter of the nozzle is not large, but the current thrown into the fire is strong. Consequently, copper-bellows are preferable. When the working of the forge is in a medium state, the bellows throw into the crucible eighty-one cubic feet of air in a minute, under a pressure of one and a half pounds to the inch, and when the forge is in its highest activity, the same quantity, but under a pressure of two pounds. So important is the supply of a strong current of air from the bellows, that this circumstance alone makes a difference in the yield of the steel from the pig-iron, of from 62 to 74 per cent. The dimensions of the crucible are two feet six inches from the tweer to the opposite side, by two feet eight inches in depth. Many circumstances relating to the shape of the crucible, are of the highest importance; and

must be learnt from the plans laid down in the treatises on metallurgy.* The operation of refining is commenced by throwing into the crucible, filled with charcoal, half a cubic foot of rich cinders, and upon this a plate of cast-iron of the weight of thirty or forty pounds, —the mass being sunk about three inches into the crucible, and situated against the side opposite the tweer. It soon begins to melt, and sinks into the fuel, where the decarbonization gradually ensues. The refiner perceives by an instrument when it hardens, or has come "to nature." When this occurs, it will form a plate an inch thick on the sole of the crucible. He then adds a second charge precisely after the manner of the first, only its weight is seventy-five or eighty pounds. When this mass is liquefied, a part of the scoriæ is run off, to facilitate which, small portions of clay are sometimes added. The metal of the second charge completely dissolves that of the first, when they are in the right proportions to each other. It requires half an hour to dissolve the first mass, and half or three quarters of an hour longer for the liquefaction of both masses. A third mass (of the same weight as the second) is added on the coagulation of the previous charges. This induces a fusion of the whole in a quarter of an hour. A fourth mass of sixty or sixty-five pounds on being added does not wholly redissolve the previous additions. At this period of the process, an iron is thrust into the crucible, and the steely mass is withdrawn; and by the appearance it presents, the workman judges of what is requisite to complete the operation. The loup of steel is now almost entirely formed. The fifth mass (weighing forty or forty-five pounds) is melted like the others; after three quarters of an hour, it coagulates to the consistence of butter. The sixth charge of thirty pounds is put into the crucible as the loup with its cinders is partially withdrawn; it melts and forms a hole in the main mass. The seventh and last mass of the same size is added in a similar manner, which brings the loup in the crucible to a level with the mouth of the tweer. When the last addition is refined, the loup is taken to the anvil and divided into eight or ten wedge shaped pieces, a process which is easily effected. The mass is thought to be perfectly refined, if when withdrawn from the crucible, its lower part exhibits a white heat. The loup is ordinarily of four hundred

* See Archives de M. KARSTEN, t. 18, p. 332—397.

pounds weight, of which one forge makes three in twenty-four hours. But the rapidity of the process depends much upon the nature of the pig-iron employed. The steel forms much more rapidly if it be produced from a mixture of two thirds spathic iron with one third brown hematite (limonite), but the steel is not so good. It is common however, in some forges to employ two masses out of the seven of this kind of cast-iron, and which, instead of being lamellar and white, is somewhat fibrous and gray. These two pieces, moreover, are the first that are added to form the loup.

But notwithstanding the principal details of this art are to be found in the source above indicated, it is yet necessary to observe that no branch of iron-making stands more in need of the services of workmen experienced in the business than the present. The fabrication of steel is yet almost wholly an empirical art, in the practice of which the workman finds for each peculiarity or accident which occurs, a remedy, or mode of precedure, suggested by tact and experience only; and hence no attempt to establish this nice manufacture with us, ought to be made, without securing the assistance of European workmen of approved skill.

The ores of iron enumerated, are all that we appear to possess, which are capable of being turned to account in the manufacture of iron,—specular iron not being found with us in sufficient quantity to be deserving of economical notice: it was merely detected at a few spots and mostly in the eastern parts of the State (545, 546).

Unsuccessful attempts have indeed been made to explore a highly ferruginous hornblende both in Weston and Litchfield as an iron-ore; and at the former of these places many years since, a small portion of this mineral was actually smelted and from it metallic iron obtained. But although this rock has in some countries occasionally been worked as an iron-ore, there can be no question that it would prove unprofitable to pursue it here in the present abundance of better ores and the low state of metallurgic skill. The locality of Weston is about one mile north of Sandford's mills. The rock (110) forms large beds in connection with gneiss and mica-slate. It separates by means of three sets of cleavages into large rhomboidal fragments, whose surfaces when exposed to the weather present a pitted or corroded appearance; and when struck with a hammer, it resounds with a metallic, ringing noise. To this circumstance and the high specific

gravity of the rock, are no doubt owing the impression of its value as an iron-ore. The other locality is near Bradleysville in Litchfield. It was explored very slightly eight or ten years ago by Mr. E. Horton. It contains small portions of magnetic iron-pyrites (460), but in other respects resembles the variety just described.

The remaining ores of iron to be mentioned, though valueless as sources of metal, are nevertheless of considerable importance for other purposes. They consist of three species, *Iron-Pyrites*, *Magnetic Iron-Pyrites* and *Mispickel;* the last will be noticed under arsenic.

Iron-Pyrites.—This is one of the most widely diffused of all the ores of iron. Few rocks or formations are found to be destitute of it in a greater or less quantity, when examined through any considerable extent. Its peculiar yellow color, bright metallic lustre, taken with its considerable hardness and the very common cubic form of its crystals, serve to render it easy of recognition. It consists of iron 46 and sulphur 54. But notwithstanding the large proportion of iron, its mineralization by sulphur unfits it for reduction to the metallic state; and its only uses are to afford sulphur, sulphuric acid, sulphate of iron and alum. It is thus employed in Germany on a very extensive scale. Large earthern retorts are charged with the ore, and heat is applied until about 17 p. c. of the sulphur is distilled over, and which is condensed in suitable chambers. What remains behind is thrown into heaps on floors covered with clay and surrounded with raised edges of the same material, and in this situation is exposed to the weather,—water being added from time to time to dissolve out the copperas formed. The solution thus obtained is evaporated to a proper degree of concentration, and suffered to crystallize in wooden vats if copperas be the object, or evaporated down and distilled to dryness if sulphuric acid be the product desired. The solid residuum in the latter case is a red powder, used as a pigment in the arts under the name of *colcothar*, and which is either a pure peroxide of iron or a mixture of persulphate and peroxide, according to the intensity of heat applied in the process. When the ore under consideration is diffused through an argillite, its spontaneous decomposition gives rise, with addition of ammonia or potassa, to the formation of alum as well as of copperas. Iron-pyrites is the frequent attendant of gold,—the precious metal existing interspersed through the pyrites often in a proportion no greater than one five

thousandth of its weight. This variety, called the auriferous iron-pyrites, can sometimes be detected by its peculiar golden color, as well as from its unusual tendency to suffer decomposition.

Allusion will only be made to those localities of this ore which seem likely to lead to such discoveries, as may prove useful in some one or other of the ways above mentioned; for though its wide and almost universal diffusion through all our rocks, with the exception of the sandstone conglomerates, is continually giving rise to deposits of bog iron-ore and frequently yields an essential ingredient in forming soils suited to vegetation,* still these uses demand no formal notice in this report.

No deposit of iron-pyrites alone, has yet been found of sufficient extent to justify either of the manufactures above alluded to, nor has any of this ore been detected including appreciable traces of gold in Connecticut. A few of the most promising districts in which to search for such ores however, require to be indicated. A place called Brimstone-ledge, a little east of North Madison meeting-house, presents favorable indications of this ore (575) along with magnetic iron-pyrites. A considerable vein of quartz was observed to contain it (568) in the vicinity of the coal-digging at Newtown, both in a crystallized and massive state. The plumbaginous mica-slate thrown out from the excavations for coal embrace thin films of the same substance (151). Considerable pits were formerly sunk in Winchester, on the land of Capt. SMITH, and among the refuse thrown out, traces of iron-pyrites are observed. This is probably the substance which led to the enterprise, but in what quantity it exists it is impossible from present appearances to say. The stone quarries on Connecticut river, opposite to Haddam, embrace beds of micaceous gneiss, which are occasionally rich in iron-pyrites, chiefly however belonging to the species, white iron-pyrites. It occurs associated with tourmaline and a variety of hornblende, known under the name of anthophyllite. At a digging for coal in Windsor near Pequonnoc, a fissile shale (279) is abundant, containing between its layers radiating laminæ of iron-pyrites. It is a rock sufficiently analogous to the true alum-slate, to invite attention to the pyritiferous slates of the sandstone formation.

* The existence of iron-pyrites in a soil containing lime, leads to the formation of gypsum.

Some indications of the auriferous variety were noticed in the chlorite-slate formation of Orange. A decomposing iron-pyrites, in cubical crystals, with dull brown surfaces, was frequently observed in the neighborhood of Savin-rock; and an ochre, rarely embracing portions of undecomposed ore, occurred disseminated through a quartz-vein several feet in width, in the central part of the town at Lambert's mine. Specimens from both these places were carefully subjected to washing by Mr. FORREST SHEPHERD, as well as to trials in the humid way, without leading to the detection of gold. Still, as the appearances are so favorable arising out of the aspect of the ore and the coincidences of geological formation, the prosecution of inquiries in this vicinity ought to be continued, if not for the economical, at least for the scientific value of the discovery.

Iron-pyrites in very insignificant quantity was often ascertained to be the substance upon which had been founded the idea of the existence of valuable mines. It had thus excited attention at the following places:—on land of Mr. BOOTH one mile west of Stratford, an excavation in gneissoid dolomite near the lime-kiln of Mr. P. CHAPMAN in Ridgefield, bed of the Housatonic half a mile south of the furnace in Kent and at the celebrated silver-mine of Ashford.*

Magnetic Iron-Pyrites.—This ore is easily distinguished from iron-pyrites, by its almost invariably massive structure and inferior hardness, and from other ores by the same properties taken with its metallic lustre and bronze-color. Its powder is a dark grayish black, and is attracted by the magnet. It consists of iron about 60, and sulphur 40. It is less widely disseminated than iron-pyrites, though it sometimes forms powerful beds in the primitive rocks. Its uses are similar to those of the preceding species. Three remarkable localities of it are known in the State, which exist in the following towns, Trumbull, New Fairfield and Litchfield.

The magnetic iron-pyrites in the first mentioned town occurs, entering into the composition of the remarkable topaz-vein and is as-

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* It is quite probable, that the exploration made about seventy years ago in Cornwall was in pursuit of this ore, together with the magnetic iron-pyrites and sphene, as samples of these substances were detected among the fragments at present lying about the excavations. The rock is hornblendic gneiss, and contains partial veins and seams of quartz, through which are disseminated pyroxene, feldspar, and the minerals just enumerated (535).

sociated with fluor, and small quantities of yellow copper-pyrites, and common iron-pyrites. These minerals together, form a vein from ten to eighteen inches in width, with sides of massive fluor, cutting across a micaceous limestone. The ore at this place (574) is the foliated or cleavable variety, precisely analogous to that of the celebrated deposit in Bodenmais, Bavaria; and although it does not perhaps occur in sufficient quantity to justify exploration on its own account, still should the other ingredients of the vein which are valuable, come to be explored, it may yet be found of some consequence for the manufacture of copperas.

The locality in New Fairfield is near the line of Brookfield, on the land of Mr. H. M. Kellogg. It is situated on a rise of land about sixty feet high, at the eastern edge of an extended swamp, on Rocky river. Wherever the rock breaks through the soil, it shows itself to be a decomposing pyritiferous gneiss. It has been blasted to the depth of several feet in one spot on the top of the hill, and about half a ton of the ore was manufactured during the late war into copperas by the Messrs. Tomlinsons of Brookfield, by whom it was found to yield about its own weight of this salt. The excavation made would indicate that the rock is every where more or less penetrated by the ore; while it also discovers a seam or stratum nearly a foot in width almost wholly composed of this substance,—the only other ingredients being iron-pyrites and small greenish grains and crystals of feldspar (575).

But the principal region for magnetic iron-pyrites is Prospect hill, in the western part of Litchfield. It forms an occasional ingredient in the constitution of the hornblendic rocks of this mountain, and very early excited the notice of the inhabitants of the vicinity. The most favorable place for viewing the ore is near the house of Mrs. Potter. At this place, an excavation fifteen feet deep by eight wide and high, has lately been carried into the mountain by the Phenix Mining Company, whose object was a flux suited to their copper ores in Granby. A part of the pyrites thrown out by the company still remains in a heap at Bradleysville, from the examination of which, as well as from the inspection of the sides of the adit, it is apparent that the ore forms on an average, nearly one half of the bulk of the rock. It contains traces also of yellow copper-pyrites (573). A fine spring of water issues directly from the excavation, which might

be turned to a valuable account in the establishment of a copperas manufacture. Abundance of hard wood is also close at hand. Appearances observed elsewhere on the mountain also, indicate that the supply of ore will be found abundant.

The same pyrites was formerly observed in small quantities in Reading in the bed of Saugatuck river, on land owned by Mr. Z. Hull. An examination of the specimens evinced, that it was of the same variety as that found in New Fairfield. Another locality of this species, but in quantities too small to be deserving of attention, has led within a few years to an expensive excavation in Brookfield, on the land of Mr. C. Hawley. A shaft has here been carried down to the depth of seventy feet in a quartzy rock. The ore is disseminated in threads and veins (576) through this gangue, associated with small quantities of calcareous spar, tabular spar, sphene, pyroxene and hornblende. The object in view in this undertaking, so far as it could be ascertained, was copper. It is needless to add, that all expectations of profit of any kind from this place must prove wholly fruitless. The same remark will apply to an excavation in a hornblendic gneiss, traversed by seams of epidote, and containing traces of magnetic iron-pyrites (437), which has lately been made in the northeast part of Woodbury. The object of search was gold.*

Copper.

Several ores of copper are known to exist in Connecticut, and extensive mining operations have been conducted with a view to this metal; but it still remains a matter of uncertainty, whether a sufficient quantity of copper has been realized to reimburse the expenditures thus far made, although the indications are highly favorable to the existence of valuable mines in the State. The ores will be treated of in the following order: *native copper, vitreous copper, variegated copper, yellow copper-pyrites, green malachite, blue malachite.*

Native Copper.—This species, when unmixed with other ores and earthy minerals, precisely resembles the melted copper of commerce. It is found in narrow seams, plates, threads and arborescent

* An iron-ore on Eggleston hill in Newfield, Torrington, is reported to have been examined twenty years ago with a view to working, but was found to contain too much sulphur. It is possible that it belongs to the present species.

masses, disseminated through various rocks, as well as in water-worn fragments loose in the soil. Thus far in Connecticut, it has principally been found in the secondary region, where it has occurred either engaged in trap or sandstone, or loose in the soil. A mass weighing ninety pounds, was found about fifty years ago in Hamden. It was attached to a rock with which it had been connected by metallic veins. The same vicinity has afforded a number of samples, found in the soil, and often associated with red copper-ore and variegated copper. It has of late been detected in the trap of Farmington, in small quantities.* Although considerable deposits of it are not likely to be brought to light, yet such is its value, that the the discovery of it in small quantity, if attended with other ores, must prove highly important.

Vitreous Copper.—This ore has a blackish lead-gray color, a metallic lustre and a foliated or granular texture, generally approaching to compact. It is so soft, that when cut with a knife the particles which are separated, remain upon the blade. It consists of copper 80 and sulphur 20, with a trace of iron. From this constitution it is obvious, that it must be highly prized as an ore of copper. As the Simsbury copper-mines are the leading repositories of this ore, some notice of them is required in this place. They are situated in the eastern part of the town of Granby.† The rock in which they

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* But one locality of native copper is known in the primitive, which is at a place called Lambert's mine in Orange. It is here found in a narrow quartz-vein, intersecting chloritic trap, associated with yellow copper-pyrites and iron-pyrites. Its quantity however is extremely minute, the samples requiring to be immersed in water to render its presence perceptible.

† The precise date at which these mines were discovered is not known. Their charter of incorporation is one of the most ancient conferred in the colonies. It is dated *anno regni Annæ Reginæ septimo, A. D.* 1709; and it appears from the various acts, passed from time to time during the subsequent forty years for the regulation of the mines, that they must have been wrought at this period with considerable activity. Whether they were then abandoned, and if so, from what causes, it is difficult at present to decide, from the absence of all public documents relative to its regulation. It is probable that the enterprise met with a check at this time, and it is possible that it might have been owing to embarrassments growing out of the war between England and France in 1744, and which continued four years; but more particularly to what is commonly called the French war, that commenced in 1754, and lasted for nineteen years. Not many years after the conclusion of these wars, the property was purchased by the State as a State's prison,

occur is a fine grained, yellowish gray sandstone (244) of a peculiar character, and which here appears to prevail through an extent of two or three square miles. The ore has been observed at several places in this formation, occurring in beds of greater or less extent, as well as in nodules and strings. The main working is commonly known by the name of Newgate, from the fact that the ancient excavations at this place were occupied as a State's prison for nearly sixty years. Another mine called Higley, is situated one and a half miles to the south of Newgate. It has been but partially opened, but evidently belongs to the metalliferous formation above described. The ore at Newgate as wrought at present, is disseminated through a stratum of the sandstone having a thickness of about two feet. The depth from the surface, at which the working was proceeding in 1835, was apparently about fifty feet, and the metalliferous bed dipped eastward 25°. From the extent and shape of the underground excavations it was obvious, that in following the bed downward it had formerly been much thicker in particular spots. Levels several rods in extent had also been carried laterally, both north and south. The frequent bulgings, or enlargements in the levels are encouraging, since they evince the liability of the ore to become more abundant occasionally, than it is where they are now pursuing it. Other pits have been sunk in the vicinity of the main workings, which prove also the continuity of the bed, as well as that its average yield is uniform.

Respecting the richness of the ore (which contains variegated copper and green malachite in small quantities, as well as vitreous copper,) (579), i. e. its proportion to the associated rock when picked with ordinary care, and concerning the difficulty of smelting it arising out of the nature of the gangue, it must be admitted that we do not possess information enough to come to a satisfactory decision. No facts relative to the produce of the mine during its early history can now be collected: nor would they be deemed conclusive against its present

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with the intention of employing the prisoners in the working of the mine, but the plan was never carried into effect, though it continued to be used as a prison for about sixty years. On its relinquishment for this use the State sold the property to individuals, who became organized in 1830, into the Phenix Mining Company. Under their direction several miners have been until very lately constantly employed, and large quantities of ore have been raised.

value in case it should be shown that its exploration was then unprofitable, since the modern improvements in mining and metallurgy have rendered the working of numerous mines lucrative of late years, which during the last century were abandoned as unworkable. From a variety of documents published by the Phenix Mining Company in 1831 it appears, that these ores afford an average yield considerably above those of Cornwall,* though they are spoken of as rather refractory in undergoing reduction,—as appears to be the fact also, from the failure of the company in their late attempts at smelting the ore at the mine, notwithstanding the operation was conducted by a well educated German metallurgist. The nature of the

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* The following is the report of Mr. JOHN B. JENKINS of Swansea, of his trial made in 1830, upon four parcels of the ore :—

	cwt.	qrs.	lbs.		per cent.		cwt.	qrs.	lbs.
"No. 1, wt.	4	1	17	produce	13¼	metal	0	2	5
2,	4	2	4		12⅛		0	2	2
3,	4	1	4		4⅜		0	0	21
4,	4	2	24		10⅞		0	1	26
	17	3	21				1	2	26

"The quality of the copper in each parcel is very much the same, and may be said to be of the average quality of English copper; but their smelting qualities are below the average, being rather refractory. The expense of smelting the above ores, per ton of 21 cwt. will be for No. 1, £2 11 9; No. 2, £2 9 9; No. 3, £1 18 8; No. 4, £2 8 0, exclusive of all custom-house charges. The ores, if there were any quantity of them now for sale, would bring the following prices, viz :—

"No. 1,	about	£9 9 6	At the present rate of exchange,	$44 84
2,		8 9 6		40 10
3,		2 19 6		14 08
4,		7 9 6		35 38
Average,		£7 2 0		$33 60

"These are the prices as near as I can judge of them, or as much as a smelter could now give for them at Swansea, the miners to pay freight to this place, and all expenses of ware-housing, sampling, &c. &c."

In order to show the richness of these ores when compared with those of Cornwall, the following statement of the produce of the English mines for three years, is subjoined from the same document.

Years.	Tons of ore.	Tons of cop.	Rate p. c.	Value per ton.	Total value.
1815	79,984	6,607	$7\frac{8}{10}$	£6 13 0	£582,108 0 0
1816	82,442	6,968	8	6 10 5	537,621 0 0
1817	73,727	6,608	$8\frac{4}{10}$	6 11 6	410,936 0 0

difficulty in working this ore, evidently consists in the excess of quartz with which it is associated. For although quartz is the chief flux employed in the smelting of such ores, yet when in too large quantity as here, it entirely frustrates the recovery of the metal. Its use consists in its affinity for the iron of the copper-ore, with which metal, if in the right proportion, it forms a light fusible slag, which may easily be drawn off from the heavy subsulphuret of copper. But if more silica be present than is required for the removal of the iron, it combines with the copper also, to form an irreducible copper slag (a silicate of copper). Should it prove impossible however, to smelt the ore in this country from the difficulty of obtaining other copper-ores to mingle with it, it may still be profitable to work the mines and export the ore to England. Several shipments have been made by the company, the success of which is not yet made known. The ores are carried to New Haven by the canal, a route which subjects them to but three miles of land-carriage. Taking into consideration the very promising appearances as respects the quantity of ore existing in these mines, and the favorable reports obtained concerning its yield, added to the natural facilities of location for working, it cannot be doubted, but that the Simsbury mines are yet destined to assume considerable importance as forming part of the metallic resources of the State. Should the copper-mine at Bristol, hereafter to be described, prove to be an important deposit, it is quite probable that the ore it will yield, may flux successfully along with the products of the Newgate mine. This is a consideration for the immediate prosecution of the enterprise, which has been commenced at that place under such favorable auspices.*

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* Should the exploration at Bristol prove unsuccessful however, it may be worthy of consideration, whether the Newgate ore would not admit of a profitable manufacture of blue vitriol, at least of the double salt of sulphate of copper and iron, of which there is a great consumption in the arts. It is prepared in Europe by subjecting the ore mingled with iron-pyrites, to a moderate roasting and afterwards to lixiviation. With certain ores, the process is aided by the use of dilute sulphuric acid. If the object be to separate the copper from the iron and to obtain both blue vitriol and copperas, it may be effected by precipitating the copper from the hot, concentrated solution of the double salt by means of old iron. The cementation-copper thus obtained, may then be mingled with flowers of sulphur and heated in a reverberatory furnace, whereby the blue vitriol will be formed. It is afterwards dissolved by water, and crystallized for the purposes of commerce. The liquor from whence the copper was obtained, will yield on evaporation, crystals of copperas.

Traces of vitreous copper exist at Tallman's mine in Hamden, near Mt. Carmel. It is associated with green malachite among the rubbish thrown out from an excavation about fifty feet deep, where the trap forms a junction with the sandstone (367). An adit was commenced at the foot of the hill several hundred feet distant, and carried in above one hundred feet through a red marly sandstone (242), with a view to strike this shaft. It is impossible, from the present condition of the mine, or from what can be gathered from those acquainted with the history of the enterprise, to make any satisfactory inference concerning the productiveness of this deposit.

Another locality furnishing this ore (271) and presenting more promising appearances, is situated in the same formation, in the southeast part of Cheshire, on the land of Mr. E. Gaylord. Two trenches about fifty feet long and fifteen wide and deep, have here been dug in sandstone and trap. A third excavation has been made about one and a half miles north of this last, where the working must formerly have been quite extensive. It was commenced in 1812, by commissioners appointed by the King's bench. Tradition says that a shaft ninety feet deep was sunk, and of a size sufficient in two places to receive a large dwelling house. Two ship-loads of ore, it is also reported, were transmitted at this period to England. Some attempts were made to renew the enterprise early the present century, but were soon abandoned. The mine is at present owned by Mr. Aaron Bellamy of Otsego, N. Y., who is a descendant of the individual interested in the first exploration. This gentleman, aided by a company in Canada, commenced the clearing of the mine in 1836. The shaft was completely occupied by timbers and rubbish. A small steam-engine is made use of for lifting out the water. They had descended about twenty-five feet in August last, and among the materials brought up, good vitreous copper was observed, often associated with heavy spar, and occasionally in distinct crystals (578*b*). On the north side of the shaft, a dyke of trap is visible, having the width of three feet, in contact with which the ore seems to occur. The intersected sandstone for several feet on each side, is more or less stained with malachite.

One mile west of Bellamy's mine, is still another excavation for the same species of ore. The examination was made at this place only a few years ago. An irregular trench has been excavated into

the sandstone to the depth of from six to ten feet, and for an extent of about forty feet. The ore was found intermingled with variegated copper and green malachite, and disseminated through a vein of heavy spar.

A number of rich fragments and even crystals of large dimensions of vitreous copper, have lately been forwarded for examination by Mr. ISRAEL COE of Wolcottville, who states that they were found about two miles from that village on rather an elevated ridge of land, among the rubbish surrounding an excavation made by an Englishman prior to the revolutionary war. The tradition is, that the ore obtained was taken to New York and put on board a vessel for England, and that the vessel having been burnt, the enterprise was pursued no farther. Several of the samples are attached to pieces of quartz, and are attended by small quantities of green malachite and chrysocolla. Variegated copper likewise occurs to a small extent, blended with the vitreous copper. Accompanying the specimens, were also sent samples of yellow copper-pyrites, associated with iron-pyrites in quartz, and which were stated to have been found within a short distance of the excavation.

In concluding the account of the species of copper now under consideration, it should be stated, that it occurs in small quantity at the Bristol copper-mine, intimately associated with the variegated copper (577*b*).

Variegated Copper.—This species is scarcely superior to the vitreous copper in hardness; it has a metallic lustre, and in color is intermediate between copper-red and pinchbeck-brown. On exposure to the air, it is prone to assume a steel-colored tarnish. It is usually found massive, with an uneven or conchoidal fracture. Its composition is, copper 61, sulphur 24 and iron 14; from whence, it is obvious that it is a valuable ore. A most promising deposit of this species has lately been brought to light in the north part of the town of Bristol, within a short distance of the secondary, at a place where partial excavations were made many years since in consequence of the abundant cupreous stains in the strata. The rock which was visible for many rods along a slight swell of ground bordering a piece of low, wet land, was a micaceous gneiss (364), a soft decomposing talcy mica-slate, and a decomposing granite. All these varieties were more or less penetrated by green, pulverulent malachite. On removing the surface for a few feet, traces of undecomposed ore

were detected by the original explorer, but not in sufficient quantity to lead to farther examination. The place was therefore suffered to remain in a neglected state until last summer, when a lease was taken of the region by Mr. G. W. Bartholomew of Bristol, by whom a trench twenty feet long, ten wide, and seventeen deep, was excavated. The general direction of the strata, six or eight rods north of the trench is N. E. and S. W., but at the excavation the direction is about east and west. The trench has nearly a north and south course, and cuts somewhat obliquely across alternations of vertical layers of granite (577*b*) and soft mica-slate (572*b*). The layers of granite are from one to two feet in thickness, while those of the slate are generally much less. It was found on getting a few feet below the surface that the green malachite and brown iron-ochre diminished in quantity, and that the rocks were less decomposed. Yellow copper-pyrites began to make its appearance in the slate, and variegated copper in the granite. The integrity of the rocks and the abundance of the ore increased regularly as the workmen descended, till at the bottom the granite presented several almost continuous veins, or layers of ore, which in places had a thickness of two inches. No particular care was observed in picking the materials raised, but the proprietor is of opinion that above three tons of good ore have been obtained. A shaft of six by eight feet and fifty deep, is now contracted for, and provided the ore continues as rich as it was during the last few feet of the main digging above referred to, the proprietor expects to obtain eight or ten tons of ore in its descent.

The variegated copper at this place is much the most abundant ore at present, though it is almost wholly confined to the granite, the shist affording only minute sprinklings of the yellow copper-pyrites. Traces of this last ore are visible in the granite, and in some instances appear to be intimately mingled with the variegated copper in very minute quantity. The dark gray color occasionally possessed by the variegated ore (577*b*), and the parti-colored tints offered by the streak, evince the presence of vitreous copper. It is interesting to observe also, as indicative of a metalliferous region, that the granite contains thin seams of a bluish green clay, or lithomarge; also lamellar white heavy spar, in which are imbedded perfect crystals of quartz.*

* The idea cannot but be suggested on the inspection of this ore and its gangue, that the deposits of copper in the secondary have originated from the breaking up of a primitive copper-field closely related to that of the Bristol mine.

The rocks in which these ores are found being almost wholly covered by soil and diluvium, the extent of the copper is far from having been ascertained, either in the number of repetitions, or the breadth, of the cupreous strata, or even in their length. At present every appearance favors the opinion that here is a copper-field of wide extent, and probably similar to that of Fahlun or Garpenberg in Sweden.

Variegated copper is found also in the repositories already given for the preceding species, with which it occurs in small quantity at nearly all its localities. It would appear however to be more abundant at the Higley mine, than at Newgate; and in general wherever the gangue is trap instead of sandstone, it is likely to preponderate. It occurs in specimens of the greatest purity at the quarry of Rocky Hill, Hartford, disseminated through veins of quartz in trap, and associated with heavy spar, green malachite, and blue malachite (577). It has also been found at Winsted by Mr. Boyd in small quantities, which as an indication of a copper-region is the more important, from the circumstance that the same ore attends the vitreous copper at Wolcottville, a locality not many miles distant.

Yellow Copper-Pyrites.—This ore of copper, to which so much of the metal of commerce is due, is easily recognized by its brass-yellow color, greenish black streak, and peculiar hardness, which is rather below that of fluor. It consists of sulphur 35·3, copper 34·8, and iron 29·8.

The most favorable indications of this ore found in the State, are those existing at the topaz-vein in Trumbull. It is already visible in considerable quantity among the magnetic iron-pyrites (574), thrown out during the recent exploration for fluor at this place. It shows itself again in an independent vein, distant sixty or eighty rods, S. W., associated with galena and blende (572). Considering the strength of the mineral veins found at this place, and the presence in them of the usual accompaniments of copper-ore, little doubt can be entertained that this also is destined to become at some future day, a mining district of considerable importance.

This ore has manifested itself at numerous places in the chlorite-slate formation of Orange. Near a place called Lambert's mine, where a surface-accumulation of galena was discovered many years ago, a quartz-vein containing this species, nearly a foot in width, has

been worked down to a depth of ten or fifteen feet. Iron-pyrites was the most abundant ore present, but the yellow copper-pyrites evidently improved as the workings continued. With it were associated variegated copper, and faint arborizations of native copper. The rock through which the vein cuts is a hard, chloritic trap. The explorations at this place however, are for the present suspended, although it cannot be denied that appearances less promising would secure more faithful trials in other countries. Yellow copper-pyrites is found under similar circumstances in the same town, at the three-mile gate on the Milford-turnpike, and at two places near the Derby-turnpike.

Favorable appearances of this species are observable along with the magnetic iron-pyrites at Litchfield (573); a rich sample (573*r*) was found in diluvium in the southwest corner of Southbury, near the line of Roxbury. Traces of yellow copper occur along with galena and blende at Mine-hill in Roxbury, at the Middletown lead-mine, and in gneiss, at Chaplin, Westfield in Killingly, and in Griswold.

Green Malachite.—This beautiful ore of copper is known by its deep apple, or emerald-green color and the delicately fibrous texture, or the pulverulent form, which it generally exhibits. It consists of copper 58·0, oxygen 12·5, carbonic acid 18·0, and water 11·5. It is a mineral no where worked as an ore of copper entirely by itself; but as it accompanies almost every other species, it often goes to increase in no unimportant manner the yield of copper ores in general. It thus enhances the value of the Granby ores; and should a profitable deposit of copper-ore be found any where in the secondary, the green malachite will undoubtedly enter into its composition.

The Bristol copper-mine has been mentioned as a depository of this species. Another deposit was wrought about the middle of the last century (and has been re-worked to some extent within a few years), situated in Manchester on the land of E. Willis, and included in gneiss, through which specular iron and iron-pyrites are disseminated (355, 546). A pit was formerly sunk into the rock on the hill, and at its foot near by, a level was carried in for a distance of several rods. Whether any other ore accompanied the malachite is not now apparent.

Traces of the same ore occur in West Haven on the Derby-turnpike, in a quartz-vein traversing the chlorite-slate (366). Many iso-

lated observations of this species might be quoted in various sections of the State, but they are deemed too unimportant to merit a notice in the present report.

Blue Malachite.—It only differs perceptibly (unless crystallized) from green malachite by its color, which is blue. Its chemical difference depends upon the proportion of water it contains. The only locality of blue malachite met with, was at Rocky hill near Hartford; where it was noticed in minute quantities associated with variegated copper and green malachite.

In concluding our notice of the ores of copper thus far made known within the State, it appears just to observe that the indications they afford of valuable copper-mines have been too much neglected. It is not to be expected that copper, however rich we may be in this metal, will force itself upon our regard in powerful beds and veins at the immediate surface, as do our deposits of iron-ore. Copper but very rarely reaches the surface in veins. It is seldom abundant except at a depth of from fifty to one hundred fathoms from the surface. The first twenty or thirty fathoms of good workable veins frequently exhibit nothing but quartz and brown iron-ochre, called *gossan* by the English miner; and hence the common expression among miners, that gossan occurs very generally on the back of the lodes (veins). Iron-pyrites and mispickel are often replaced at a few fathoms below the surface by tin, and this again at greater depths by copper. The best veins of Cornwall were not explored for copper until near the end of the seventeenth century, whereas their mean annual yield in copper-ore between 1726 and 1735 was six thousand tons! Williams, in his Mineral Kingdom (Vol. I. p. 232.), says, "In general I have observed that the greatest number of such veins as are roomy and capacious between the sides at a good depth, i. e. from ten to twenty fathoms down, are generally very strait and close at the superficies of the strata. . . . At the same time, it is also proper to observe, that it is very uncertain at what depth they begin to open. A great number of fine veins, with their sides perfectly close above, appearing at the superficies of the strata no wider than a common joint, the sides of the vein perhaps not an inch asunder, nevertheless gradually open downward, until the cavity or body of the vein between the sides, at twenty or thirty fathoms deep, is six or eight feet wide, or more; some, which are close above and wide

below, begin to open at two or three fathoms below the surface; others do not open until they are eight or ten fathoms down; and again some continue so close and strait for a great way down, that they are not a foot wide at twenty fathoms below the surface, which nevertheless open out to several feet at a greater depth. These remarks seem to favor strait or narrow veins, and in my observations I do not remember seeing many such as were close, extensive, or narrow at the surface, which did not open below, if there was an opportunity of seeing them at a good depth." Applying these remarks to the pyritous quartz-veins in the chlorite-slate formation, to the topaz and fluor-veins of Trumbull, the copper-mine at Bristol, the Roxbury Mine-hill veins, as well as to the lead-mines generally in the primitive, all of which contain copper, it is surely not extravagant to predict the ultimate discovery of rich copper-mines in Connecticut. Their discovery however, attended as it probably will be by much scientific research and by more or less of hazard, and demanding as it must large pecuniary resources, should in no case be attempted by agriculturalists or individuals of limited means, who, should they engage in these enterprises, would be likely in nearly every instance not only to fail of success, but finally to be overwhelmed in embarrassment and ruin. Undertakings of this nature must be left to joint-stock companies of ample capital, by whom the highest degrees of practical skill and science will always be commanded, and where the number of shares is so great that adventurers are scarcely affected by temporary losses. Such associations are already beginning to be organized in the country, and will increase in number as the value of copper rises, and as soon as our people become better informed respecting the success of English companies.*

LEAD.

Galena.—This is the only ore deserving of mention as furnishing the lead of commerce. It is a mineral in general easily known by its brilliant metallic lustre, pure lead-gray color, and disposition to cleave into cubical fragments. These properties, added to its softness and weight, are always sufficient to identify the varieties of this

* The copper-mines of England yielded between 1825 and 1835 the sum of £8,053,263. Single mines yielded in some instances a clear annual profit of from 30 to £50,000.

species. It consists of lead 85, and sulphur 14. It has been found at numerous places in the State, and has at different periods led to no inconsiderable expenses in its exploration. One of the most remarkable of these is at Middletown, directly upon the bank of Connecticut river. It here occurs in a thin bed or seam of quartz included in mica-slate, having a thickness of from ten to twenty inches. The strata dip west between 35 and 45°. The ore (582) is associated with blende, iron-pyrites, and rarely with yellow copper-pyrites. These ores however form but a small proportion of the seam, into the composition of which a plumbaginous argillite (152), or mica-slate, often enters. The galena even seems less abundant than some of the other sulphurets. The excavations prove that the mine must have been wrought formerly to a considerable extent. If it was then found profitable, it is highly certain that the present low price of lead must effectually preclude all farther attention to this repository, unless the vein (bed) opens on being wrought to a greater depth.

The more recent discovery of galena in Brookfield excited for a time, sanguine expectations of a valuable lead-mine. The examinations which have been made however, seem to prove that the ore, instead of occupying a continuous bed or vein, is rather disseminated either in small bunches or in a net-work of little veins. The rock containing the ore is white limestone, occasionally dolomitic, which in some places abounds in quartz. With the galena is associated blende (584), whose surface very rarely presents small crystals of white lead-ore. Calamine and pyromorphite are also found here. Many good mines of lead have been opened in other countries under less favorable auspices than are presented by this place. The main bunch of ore was indeed exhausted very soon; but slender threads, or *leadings* as they are called are left, which if followed will very likely conduct to richer repositories. Indeed the nature of the containing rock as well as that of the immediate vicinity, which for a considerable district (one or two miles in extent with a considerable breadth) is chiefly pure limestone though in a dolomitic country, affords much encouragement to the idea of a valuable mining district.

The next deposit of galena worthy of mention is that at Monroe, known as Lane's mine, where it exists attended with a variety of other ores disseminated through an immense bed of quartz. The

galena has never been supposed to exist at this place in sufficient quantity to authorize exploration on its own account; but being unusually rich in silver, it has excited some attention on this account. It was found by Prof. SILLIMAN to contain silver in the ratio of 2 to 3·5 p. c. compared with the metallic lead of the ore. The prospect of remuneration from the working of an ore but sparingly disseminated through so hard a gangue as quartz does not appear flattering. As the bed has been examined however to a very limited extent, future researches may lead to a discovery of the ore in greater abundance.

Several other lead-mines, but of inferior importance, have been opened in various parts of the state, to some of which it may be expected that allusion should be made, although but little information could be acquired respecting their condition. The silver-mine in Wilton is one of these. Here is an excavation said to be seventy-five feet in depth, and reported to have been made during the period of the revolution. The rock penetrated was a quartzy, granitic bed, situated in mica-slate. Among the materials thrown out were observed minute portions of galena, associated with yellow copper-pyrites, iron-pyrites, and mispickel. At Sandy Hook, Newtown, about fifty rods north of the spot where search was made for coal, is a tunnel carried for a short distance through a projecting quartz-vein contained in mica-slate. It is called a silver-mine. Attached to the walls of this excavation, traces of galena and iron-pyrites were observable. Kensington parish in Berlin has another of these old lead-diggings. The veins containing the galena, blende, &c. (581) are at the junction of a ridge of trap with indurated shale. It was explored during and prior to the revolutionary war. Unsuccessful attempts to find a body of ore were also made about thirty years ago. Rolled masses of quartz including galena have been found in Canton near Collinsville, in Bethlehem and Plymouth (581*b*), indicating the existence of veins of such ores in these regions. Galena also occurs at the cobalt-mine in Chatham, and at Trumbull near the topaz-vein associated with yellow copper-pyrites, as well as in the spathic iron-veins of Roxbury. Other indications have been observed in Bethany, in East Haven in trap at Black Rock (New Haven harbor), and in granite near the light-house, in Canton on Whortleberry-hill, and in Southington.

ZINC.

The increased use in the arts made of this metal renders its sources in the State important. The only natural ores known to exist are blende and calamine. The chimnies of the iron-furnaces in Salisbury afford considerable incrustations of cadmia, and occasionally coatings of electric calamine.

Blende.—This ore, though abundant in nature, has until within a few years been almost wholly neglected. It is now however beginning to be employed largely as a source of metallic zinc and in the manufacture of brass. It is a brittle, shining, easily cleavable ore, possessed of an adamantine lustre, of a hardness rather below fluor, and various shades of color, of which yellow, brown and black, are the most common. It consists of zinc 64 and sulphur 34, with 2 and sometimes 5 p. c. of iron. After the notice of galena, with which blende generally occurs associated, it will be easy to indicate the localities of this species. I shall mention them in the order of their apparent importance :—Middletown lead-mine (582), Chatham cobalt-mine (585), Lane's mine, Monroe (586), Brookfield (584), Kensington in Berlin (581), Bethany (565*b*).

Calamine.—It is a carbonate of zinc, consisting of oxide of zinc 65, and carbonic acid 35. It usually occurs massive, and often in a friable or earthy condition. Sometimes however, it assumes a stalactitic shape, with rough, corroded surfaces. Its ordinary color is white. It is much valued in the manufacture of brass. The only locality in the State is at Brookfield, where it occurs in white limestone (358*r*) along with blende and galena.

The *cadmia* which forms in the chimneys of the iron-furnaces at Salisbury (592) and vicinity, is deserving of economical attention, since it is the richest ore of zinc known, and is carefully preserved at all the furnaces where it accumulates in Europe, being employed in the fabrication of brass. Its origin and properties may be described as follows :—The zinc exists in the iron-ore, either in the condition of a sulphuret or of an oxide. The heat of the furnace causes it to assume the form of vapor, which in making its escape from the furnace is condensed in thin layers on the throat of the chimney where it is comparatively cold, from the frequently introduced charges of ore, coal and flux. The deposit gradually increases until it becomes

several inches thick, when unless removed with care, it is liable to separate and to fall into the furnace, producing in some instances serious inconveniences. It consists of oxide of zinc 91, oxide of lead 5, protoxide of iron 1, charcoal 1. A sample of this product of iron-furnaces from the vicinity of Salisbury was analyzed by Dr. TORREY, and found to contain neither lead nor silica. It is to be regretted that its nature has not been understood in the region of the iron-works, where great quantities of it have been thrown away as of no value.

The *electric calamine* is a still more remarkable product of these furnaces, inasmuch as it has never before been observed, except in natural repositories. It is used also in the fabrication of brass. It differs from the cadmia chiefly in containing about 25 p. c. of silica, and 7 p. c. of water. It forms stalactitic and coralloidal incrustations of half an inch in thickness, and covered by minute crystalline facets (593.) It is impossible to say how frequently this mineral is produced, or to point out the circumstances under which it forms in place of cadmia. Both substances will be found worthy of being preserved for the manufacture of brass.

BISMUTH.

Native Bismuth.—This species is found in small masses, having the peculiar color and lustre, as well as lamellar texture possessed by the bismuth of commerce. It (563) occurs disseminated through the metalliferous quartz-bed of Monroe, associated with mispickel, iron-pyrites, wolfram, galena and blende. The small quantity in which it is found, has thus far discouraged all attempts to separate it from its gangue for the purposes of the arts.

Bismuthine.—This is a sulphuret of bismuth, and has barely been detected at Haddam in the granite-vein containing the chrysoberyl. With it, occurs a yellow pulverulent substance resembling the bismuth-ochre.

ARSENIC.

Mispickel.—The white arsenic of commerce is chiefly derived from this species. It is found in several places in the State, though probably, so far as is at present known, only at one locality in such quantity as to render it of economical value. It is a mineral

very apt to be regarded by people in general as a silver-ore. Its silver-white, or steel-gray color, and high specific gravity, are no doubt the reasons of this impression. When heated on charcoal, it affords copious fumes having the odor of garlic, and a residuum of sulphuret of iron remains, which is attractable by the magnet. It consists of iron 36, arsenic 42, and sulphur 21.

The leading deposit of this ore above alluded to, is in Derby, on the land of Mr. A. Bassett (566.) It has long been known as the silver-mine, and was worked probably under this idea, prior to the revolution. It appears to occur in nests and beds in a quartzy gneiss, and contiguous to a powerful dyke of trap. A number of excavations were made for the ore; some of which were vertical, and one horizontal. Whether any continuous bed of it exists *in place*, it is difficult to say, but large masses of it are frequently met with dispersed through the fields in the vicinity.* Galena, blende and iron-pyrites are often observed, associated with the ore. Other less remarkable localities of this species are Lane's mine in Monroe, the lead-mine in Wilton, and near the Quaker's farm-factory in Oxford (566*b*) and at Bethany (565*b*.)

COBALT AND NICKEL.

Cobalt is a metal hitherto unemployed in a state of purity in the arts. Its only use is for imparting a rich blue, by the union of its oxide with certain alcaline and earthy glasses and enamels.

Smaltine.—This species is the chief source of the cobalt thus employed in the arts. Its color is tin-white, and its hardness is nearly equal to that of feldspar: it is massive and fine granular. It consists of arsenic 65·7, cobalt 28, iron 6·2. It is prepared for use by exposure in a reverberatory furnace to the action of heat and air, by which operation its elements are oxidized, and the arsenious acid is principally expelled in the form of vapor,—an impure oxide of cobalt remaining, which is well known in commerce by the name of *zaffre*. From this, the beautiful blue colored glass, called *smalt*, is

* The proprietor of this mine has been in the practice of applying it to a very ingenious use, viz. that of expelling crows from his corn-fields. Fires are kindled on the windward side of a field, and fragments of the ore thrown upon them: either the odor of the garlic, or the deleterious impregnation of the atmosphere with arsenic, effectually deters this cautious bird from his customary depredations.

obtained, by fusing it with a mixture of sand and potash. The zaffre also furnishes the pure oxide of cobalt, with which the porcelain-manufacturer stains his ware of an intense blue.*

Smaltine is found at Chatham at the well known cobalt-mine, and has been considerably worked at two periods; the first during the last century, and the last, about fifteen years ago. The mine is situated upon a mountain three hundred feet above the little lake, at its northwestern base. The prevailing rocks of the mountain are quartz-rock and mica-slate. The direction of the strata is very nearly east and west, with a dip to the north of between 40 and 45°. The mine is situated about seventy-five feet up the mountain, and forms a thin bed or seam in the mica-slate, whose dip and direction conform precisely to the general stratification of the mountain. The stratum embracing the ore appears to run directly across the mountain, and has been more or less excavated for nearly the whole extent. Its thickness is with difficulty inferred from the present condition of the mine, but appears to be about one foot; it consists of an aggregate of quartz, garnet and hornblende. The greatest depth to which the ore has been followed in any one place is said to be forty-five feet. It is accompanied by copper-nickel, blende, galena, and traces of yellow copper-pyrites (585, 564, 567). The last working of the mine was carried on by Mr. Seth Hunt, and was persevered in for upwards of three years. It was abandoned in consequence of the difficulty experienced in separating the nickel from the cobalt.

The *copper-nickel* is closely associated with the smaltine (564), though obviously in small quantity compared with the latter species. It is massive and compact in its texture, and is easily distinguished from the other ores with which it is associated, by its reddish gray color and metallic lustre. It consists of nickel 15·6, cobalt 4·6, iron 16·6, arsenic 46, antimony 1·04, sulphur 8·6.† The universal dissemination of this species through the smaltine, renders the profitable working of the mine a nice operation, but one for which the advanced state of chemical science is fully prepared, at least so far as the separation of the cobalt from the nickel is concerned. Such ores are wrought in various parts of Germany with success, so that the only

* The cobalt mines of Saxony annually yield above $225,000 in value, of smalt.

† The specimen analyzed was blended with smaltine.

question concerning the propriety of re-commencing the working of this mine must turn on the quantity of ore it is capable of supplying.*

MOLYBDENUM.

This scarce metal has heretofore been applied to but a single use, the fabrication of the *carmine-blue*, a pigment of some celebrity. Its constitution chiefly depends on the presence of molybdic acid. It is formed by the following process; molybdenite (sulphuret of molybdenum) is boiled with sixteen times its weight of water until the water is reduced to one third its volume. A small quantity of hydro-chloric acid is then added in drops, and afterwards one twenty-fourth its weight of metallic tin: the blue precipitate appears in a few days.

The gneiss quarries of Haddam have occasionally produced the molybdenite, also those in Chester near Deep River (587).

TITANIUM.

Like cobalt, this metal is never employed in a state of purity. In combination with oxygen as it exists in rutile, it has of late been used to stain porcelain of a peculiar brown, and for the more important purpose of imparting to the artificial porcelain-teeth a yellowish tinge. Rutile has been furnished for this last purpose from the mica-slate of Monroe, where it occurs sparingly disseminated in rounded grains and crystals (536). It is found also in Plymouth, Granby, North Greenwich, and probably in many other places, without occurring any where in quantity. A few nearly transparent crystals of a blood red color have been found in the china-stone quarry of Middletown.†

URANIUM.

But one of the oxides of this rare metal has as yet been employed in the arts: the protoxide is used for imparting to porcelain a pe-

* The general method at present pursued in the treatment of such ores is, to subject them to a very intense heat, equal for example to that of the porcelain-furnaces, in order to expel the sulphur and arsenic they contain. The residuum is then treated with such a quantity of nitre or of carbonate of soda, that from 12 to 15 p. c. of the metallic matter may not be attacked: the nickel being less oxidable than the cobalt, collects together into a mass by itself, while the scoria containing the cobalt is almost perfectly free from nickel.

† Rutile sells in New York at eight dollars per pound.

culiar yellow tint, as well as for producing a rich shining black. *Pitchblende* is the ore of uranium, from which this oxide is obtained. It usually occurs of a pitch black color, massive, compact, and very heavy. Its hardness is nearly equal to that of feldspar. It consists of the protoxide of uranium, with traces of iron, lead, and rarely of cobalt. This ore occurs in the china-stone quarry at Middletown (560), associated with blende (whose form of crystal it sometimes imitates), columbite and rutile. Thus far, it has only been found in very small quantity. Closely associated with it also, is found the green uran-ochre; an ore never before observed, and which consists of the protoxide of uranium in a state of freedom as respects other metallic oxides, and suited to the purposes of the porcelain manufacturer. Its quantity, however, is small.

COLUMBIUM.

No useful application has as yet been made of this metal, which may perhaps be attributed to its great scarcity, rather than to its unfitness for use. The State of Connecticut furnished the first sample of the ore to science; and in consequence of its American origin it received in England the name of columbite, and the new metal it was found to contain, that of columbium.*

The china-stone quarry at Middletown has furnished the most extraordinary specimens (559) of columbite yet described in the world. A single group of crystals obtained at this place weighed fourteen pounds. It occurs in crystals disseminated through the feldspar, many of which are very remarkable, not only for their size, but for their perfection of form. It is also found in small quantity at Haddam, in the granite-vein which contains the chrysoberyl (558).

TUNGSTEN.

This is another of the rare metals not hitherto applied to any use, except on a small scale as a yellow pigment in the state of tungstic

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* The first sample was sent by Gov. WINTHROP to Sir HANS SLOANE, and was deposited with the collection of this gentleman in the British museum, where it was examined by Mr. HATCHETT, and afterwards by Dr. WOLLASTON. The specimen was supposed to have been found near New London, which was the residence of Gov. WINTHROP; but as the ore has not been re-discovered in that vicinity, it is more probable that it was obtained from the region of Middletown.

acid. Still its presence is every where viewed with interest, as being a metal indicative of tin. Three of its ores are found at Lane's mine in Monroe; viz. Wolfram (557), Tungsten (359), and Tungstic ochre (561). They likewise occur at the topaz-vein in Trumbull.

It is not perhaps a matter of wise regret that gold and silver do not find a place among the metallic productions of the State. Should these metals be detected within our territory, their pursuit would neither operate favorably upon our agricultural interests, nor tend to the successful working of the more useful metals, whose existence has already been pointed out. That gold is not likely to occur to any extent, may be inferred from the limited development of the gold-formation, and from the improbability that a metal which like this, presents itself in every rich gold-district in grains of considerable size, should have escaped observation in a country so old and thickly settled as Connecticut. Should silver ever be worked, it will probably be in connection with galena; and of this, the only promising deposit is that of Monroe.

As tin is an ore belonging to granite, it is within the range of possibility that we may yet discover this valuable metal. The occurrence of the tungsten-ores at Monroe and Trumbull, as has already been remarked, invite researches in that direction. The china-stone quarry of Middletown also, is another quarter where it is likely to be discovered.

II. Coal.

It is an observation as well founded in fact as it is important in practice, that coal occurs only in rocks of a peculiar nature and geological age. Good workable coal has never been found either in the oldest crystalline rocks, or in the newest formations of the secondary and tertiary. Accordingly, in three quarters at least of our territory,—in all but the secondary region of the valley and the limited basin of Woodbury and Southbury,—the existence of coal is as certainly denied as is that of rock-salt in the same district. The discovery of anthracite at Worcester (Mass.), in mica-slate, (which graduates into argillite,) and unattended with any secondary or recomposed rocks and vegetable remains, is the only apparent exception to this rule. It may well be questioned however, whether this seam of plum-

baginous mica-slate deserves the name of coal. It is ignited with great difficulty, and according to the experiments of Mr. Bull, its heating power compared with the Lehigh-coal is only one half. Its greater specific gravity by one-third than anthracite shows still farther, the preponderance of the rock over the carbonaceous matter.

The only serious attempt which has been made to obtain coal in the primitive of Connecticut, is at Sandy-hook in Newtown. The excavations have been made into a highly glazed, plumbaginous mica-slate (151), on the banks of a small river (the Potatuck). The working was still in progress last autumn, but has not been resumed this year. A level fifty feet in extent, was carried into the mountain on the west side of the stream. Judging from the materials thrown out, it would be a liberal estimate to rate the richest samples as containing ten per cent of carbon; nor could any ground be perceived for inferring an improvement in the rock by a further prosecution of the enterprise. As however iron-pyrites is disseminated in minute crystals through the rock, and especially through a quartz bed near by, some hopes may be entertained of finding it in sufficient quantity for the manufacture of copperas. There is surely nothing else deserving attention in the vicinity, and all expectation of coal ought to be abandoned without delay.

The geological structure of the secondary does not preclude the existence of coal, though the character of the formations and the failure of all attempts heretofore made for its development, give but a feeble promise of the addition of this valuable mineral resource to the State. The great central valley abounds in a conglomerate-rock, obviously composed of fragments derived from the contiguous primitive; nor is it wholly wanting in bituminous shales and dark colored sandstone-slates, which are the more immediate attendants of coal deposits. Still these have not yet been found collectively arranged in that order of alternation, and penetrated and interleaved by vegetable remains and argillaceous iron-ore, circumstances which are at least requisite to constitute safe indications for boring. The hopes that have been entertained have chiefly been founded on bituminous shale and limestone, black fissile slate, and thin interrupted seams and grains of indurated bitumen in sandstone and amygdaloid. Fragments of coal have not arrested attention on the banks of rivers or streams, or been detected in a more commi-

nuted state, blended up with the soil or diluvium of the country. The frequent intersection and disturbance of the secondary by trap dykes in this region, have also failed to afford intimations of the combustible in question.

It is unnecessary to particularize the character of the numerous diggings which have been made in this formation, since they are all alike destitute of the indications essential for success; and I am happy to state, they are nearly or quite abandoned as hopeless, by all prudent persons.*

III. Plumbago.

This valuable mineral, for which new uses have within a few years been discovered, is found in several parts of the State, and in two places at least in very encouraging quantity. It is often called *graphite* by mineralogists, and in common life is known by the very objectionable denomination of *black-lead*, a name calculated to convey the idea that lead is an ingredient in its composition, whereas it does not include a particle of this metal, but consists essentially of carbon. It is therefore closely allied to anthracite, since the purer varieties of plumbago contain ninety-five per cent of carbon, the remainder consisting of the oxides of iron and manganese, and of silica and titanic acid. In some varieties alumina enters in large proportion, and taken along with the other foreign ingredients, reduces the relative proportion of the carbon to sixty or seventy per cent. The purer and more compact varieties are used for the fabrication of pen-

* Impressions of plants are of very rare occurrence at the places where excavations have been made, and in many instances altogether wanting. A cupriferous sandstone-slate in Suffield at Enfield falls, occasionally embraces compressed stems, apparently of calamitæ, which are converted into brown coal (259). Similar remains were noticed at Southington, in one of the quarries of hydraulic lime. The coal-digging in Durham also afforded some obscure vegetable impressions. The coal from these plants burns with a feeble flame and a disagreeable peat-like odor. That found in trap at Farmington (311), Southbury, and at Rocky Hill, Hartford (320), ignites slowly and burns without flame or odor: it is therefore, rather referable to anthracite than to bituminous coal. The coaly matter, occurring in seams with crystals of dolomite in marly shale at Berlin and in the bituminous shales of Southbury, is compact bitumen. In many instances when freshly taken from the quarry it is semi-fluid, or only so much inspissated as to form what is called the elastic bitumen, or mineral-caoutchouc. It burns with a white flame and much smoke.

cils, while the common kinds are employed in the manufacture of crucibles, to the composition of which this mineral imparts the valuable qualities of strength and infusibility. Other uses of plumbago are, to polish iron-stoves, rails, &c., to which it imparts a handsome gloss, at the same time that it preserves them from rusting. Still another application of this substance is, when mingled with oil, to diminish the friction of machinery; it is said also to afford security against fire, when formed into a paint and laid upon the roofs of houses.

A plumbago-mine was worked to some extent seventy or eighty years ago in the northwest corner of Ashford, on land then owned by Mr. Adonijah Backus. It had been previously opened, but at what period is not now known. At the time here mentioned however, a number of tons of plumbago were obtained. The mine was worked in the manner of a quarry, and an excavation made of considerable extent. This is now completely filled up with stones, which have been carted thither from the contiguous fields; a road also passes quite across one end of the trench. The rock of the vicinity is gneiss, analogous to that embracing the plumbago at Sturbridge, which is about six miles in a northeasterly direction from this place. And such is the conformity of this direction with that of the stratification of the gneiss, as almost to justify the opinion, that the Ashford and the Sturbridge deposits of plumbago have a connexion with each other. This suggestion is the more probable from the fact, that the gneiss rock is similar at both places, and contains scales of the mineral in question at several intermediate points.

Whether the Ashford mine is worth pursuing, can only be ascertained by clearing out the rubbish with which the original excavation is filled. Mr. Benj. Simmons, who now owns the estate on which it exists, states that a number of persons from Colchester made some trials for the substance as late as 1813. The attempt however, was confined to an examination of the bank of loose materials, thrown out by the company who worked it eighty years ago. They obtained among these, a waggon-load of plumbago in a short time. It is a matter of regret that the situation of the mine is low, and that the course of stratification in the engaging rock (which the deposit undoubtedly follows) leads directly along the edge of a wet, swampy swale of land.

Another depository of plumbago is in the western part of Cornwall, on a mountain nearly three hundred feet high, and situated directly upon the eastern bank of the Housatonic river. It is the property of Mr. GIDEON P. PANGMAN. The rock is gneiss, and wherever it comes into view on its western slope, this mineral may be detected as entering more or less into its composition,—sometimes in large proportion (74), forming a plumbaginous gneiss. A trench has been excavated at an elevation of about one hundred and fifty feet above the river, nearly six feet wide and twenty long, into a rock made up of a gray pyroxene, through which large laminæ of plumbago are disseminated (369). The cross seams of this bed present a coating of very pure plumbago, about half an inch in thickness. The wide diffusion of the mineral at this place, affords some encouragement that a vein or bed of it fit for working will ultimately be found. Less promising indications of the same mineral were noticed at Danbury, near the factory of Col. WHITE (371*y*), near Foster's factory in Reading, in the north part of Bethany (371), at Humphreysville, in Bolton, Mansfield, Ashford and Union.

IV. GEMS.

Under this general head there is little more to report than the fact, that most of the precious stones exist in the State. As yet they have attracted little or no notice for supplying the demands of jewelry. Specimens of asteriated sapphire have been found in Litchfield, but wanting too much in transparency to constitute them beautiful gems. A very extraordinary repository of topaz has been brought to light at Trumbull only within a few years, where crystals of unprecedented dimensions have been found in abundance. But few pieces however, have as yet been met with, having the requisite transparency to answer the purposes of jewelry. The chrysoberyl of Haddam is nearly in the same condition; for although it exists in crystals of unusual size, it yet lacks the higher attributes of opalescence and clearness, which are necessary to render it valuable as a gem. Iolite has been obtained from the albite-granite of Haddam (481) and in the vicinity of Norwich (482*b*), of a remarkably rich blue color and exhibiting the interesting property of dichroism, which recommends it both as an object of beauty and as an optical curiosity. Haddam has also afforded a number of exquisitely beautiful beryls of

perfect transparency, and well fitted for ornamental purposes. A transparent, garnet-red rutile occurs very sparingly in the china-stone quarry of Middletown, which has been cut and found to possess the rich color of the fine Bohemian garnet, along with the metallic, adamantine lustre of the diamond. The agates of Farmington, East Haven and Woodbury, as well as those of many other places in the trap-region though small, are yet possessed of considerable beauty.* A number of them have been cut in the form of seal-stones, which fully rival those of Scotland and Germany, in the delicate arrangement of their layers and the richness of their colors. Zircon, though found in two localities, Haddam and Middletown, has not yet presented itself in crystals of the requisite color or transparency, necessary to constitute it a gem. The same may be said of the garnet, which is every where found through the primitive of the State.

V. Polishing and Grinding Materials.

Those minerals possessed of the highest degrees of hardness are employed for cutting, polishing and shaping bodies less hard than themselves. The diamond being at the head of the series for hardness, enjoys the highest value for this purpose. Besides its well known use for cutting glass, its powder is used in polishing that gem itself, and for slitting and shaping all the others. As the diamond-powder is so expensive however, such minerals as stand next in hardness are resorted to; and the emery, which is an impure variety of corundum, is most in esteem. It is chiefly derived from Naxos and other Grecian islands, being there found in large loose blocks; and from Saxony, where it occurs in a kind of talc-slate, presenting a fine granular appearance like greenstone. This precious substance, of which such vast quantities are consumed not only by lapidaries, but in burnishing steel, and in polishing hardware goods generally, has been found repeatedly in various parts of Litchfield, disseminated with talc and apatite through blue kyanite: and inasmuch as the same aggregate exists in the mica-slate of that region, it will with propriety become an object of search in the future investigation of

* The calcedonic balls lately discovered in Torringford by Dr. Hudson, from the size of a hen's egg to several feet in diameter, are very handsome; some of them having rich carnelian shades and a milky translucency (504y, 504r).

that part of the State. It also occurs in small crystals with bucholzite and edwardsite, at the falls of the Yantic in Norwich.

Whether an adequate supply of the emery can be found or not, we at least possess a valuable substitute in the topaz of Trumbull, which has been too long overlooked, since the topaz-rock of Europe is known to answer an excellent purpose as a polisher of gems. We have a right to predict that the topaz of Connecticut will be found superior to that of Saxony, inasmuch as it is purer from foreign intermixtures: the European topaz-powder is derived from an aggregate of topaz, clay, tourmaline and quartz, whereas that of Trumbull generally occurring in large crystals, some of which are four or five inches in diameter, can easily be picked so as to be perfectly pure. To prepare it for use, it will only be necessary to crush it in iron-mortars, to agitate the powder in large vessels of water, and to separate it by subsidence into qualities of different degrees of fineness. If suitably prepared, there cannot be the least doubt that it may take the place of emery in our axe and gun-factories with great advantage.

Beside the topaz, they are in the habit of employing a massive garnet in Saxony and Bohemia as a polishing material. Of this we have several deposits in the State.

The first to be mentioned is a bed in Plymouth, half a mile southeast of Mr. Hoadley's factory. It was opened seven or eight years since, and explored to some extent, under the mistaken idea of its being an ore of iron (521*b*). The layer of garnet is at least six feet wide, and nearly vertical in its position. It is very slightly intermingled with other substances,—quartz, pyroxene and calcareous spar being the only species observed connected with it, and these in trifling quantities.

A second locality of massive garnet is in Reading, on the cross-cut turnpike, four miles south of Danbury. It occurs directly by the road-side, and is extremely abundant: the only associated mineral is a granular pyroxene, nor is this generally present. Masses of the pure garnet many feet in diameter were common in loose blocks (522*b*). It undoubtedly here exists *in place*, and in the greatest abundance.

A bed apparently of inexhaustible extent, and admirably fitted to the purpose, is also found at North Madison. It is situated a quar-

ter of a mile east of the meeting-house on the Essex-turnpike, and very near the road. The rock has the appearance of a fine grained red sandstone (527), but when nearly examined is extremely brilliant. It is almost wholly made up of garnet, and is reduced to a fine sand with great ease. It is connected with the gneiss formation, and attains the surface only for a rod or two in extent. It is much to be desired that the proprietors of the localities enumerated will soon cause experiments to be made of the adaptedness of this mineral to the purpose here specified.

The fine garnet-sand (528) on the shore, at the quarry of Millstone point in Waterford, may answer the same purpose, provided it can be collected in sufficient quantity.

At Andover, on some low land owned by Mr. Elisha Perkins, is found an ash-gray, siliceous loam, which proves very useful as a polisher of brass and silver. It is so light when dry, as to float on water, and is perfectly impalpable in its texture. When heated to redness, it takes fire, and turns to a pure white color, at the same time diminishing in bulk. When heated with borax before the blowpipe, it melts into a transparent glass. A sample which had been dug for upwards of a year afforded the following results when submitted to analysis:

Water of absorption,	7·
Vegetable matter,	23·
Silica,	64·
Alumina,	5·
	99·

The property under consideration evidently depends upon its being siliceous in its constitution, and impalpable in its texture. It is prepared for use by burning. The supply appears to be unlimited.

A similar variety is said to occur in the western part of Monroe.

Rocks adapted to the purposes of common grindstones do not appear likely to occur in Connecticut. The qualities essential to such stones are a small and uniform size of the grain, a state of aggregation not too difficult to overcome, and hardness sufficient to abrade steel. A fine grained, quartzy mica-slate was obtained for grindstones in Black-hollow, Marlborough, during the last war. At that time, they were held in considerable esteem, and were used in the

public armory at Springfield (Mass.). They are not in much demand however, at present.

A red sandstone quarry (245*y*) lately opened on land of Mr. Asahel Mix, between Bristol and Farmington, promises to yield a stone closely resembling in fineness of grain and the character of its grit, the English Newcastle stones, so much esteemed for grinding edge tools, especially axes. No trial has yet been made of this stone for the purpose in question. Its contiguity to the large axe-factory at Collinsville, it is to be hoped will ensure it an early examination. It is probable also that the fine grained, red sandstone of North Branford (249) alluded to below, would answer a similar purpose.

Millstones are occasionally hewn out of granite in various parts of the State. No material however, appeared to possess such advantages as a carious jasper (502, 589) found disseminated through the bed of porcelain-clay in New Milford. Provided they occur in sufficient quantity and in masses of a suitable size, they will probably be found capable of being substituted for the French buhr-stone. A cellular drusy quartz (493*b*) found on Whortleberry-hill in the south part of Canton, was used during the last war for millstones. Several acres near the top of this hill are strewed over with large masses of this rock.

A fine grained red sandstone (249), found in North Branford, seems well suited to the purposes of the marble-polisher, to be used as a muller. It is uniform in its texture, compact, and yet possessed of the requisite porosity for the imbibition of water.

No good oil-stones have been detected in the State. The only approximation to an oil-stone is a compact feldspathic rock (165) in Bethany, found contiguous to granite (21). The mica-slate of Bolton and Vernon is extensively used as coarse whet-stones for sharpening sythes.

VI. Soapstone and Potstone.

No mineral substances are in general more easily detected than soapstone and potstone. An unctuous feel, and a softness sufficient to allow of their being easily cut with a knife, are the chief characters necessary for their recognition. It is deserving of remark, that these names (and many others by which certain varieties are denominated) all refer to but a single mineralogical species, which is

talc. Those varieties depend upon certain accidental diversities in mechanical composition and the presence of foreign substances. The term *chlorite* is employed to designate a dark green, firmly cohering, granular variety; *potstone* to denote a lighter colored, finer grained and slaty variety; while *steatite* or *soapstone* is perfectly compact or impalpable in its composition, and is of various colors, of which green, gray and reddish white are most common. Chlorite and potstone have been employed among all nations, from time immemorial, in the fabrication of vessels adapted to domestic use. They constitute a species of natural pottery, which only requires to be shaped on the lathe, or with the knife, to fit it for immediate use; and articles of this manufacture are admirably adapted to sudden changes of temperature. Those used in cooking therefore, admit of a very simple and effectual mode of cleansing,—only requiring to be heated in the fire in order to be restored to their original sweetness and purity. The steatite or soapstone, which when taken from its original repositories is often so soft as to admit of being kneaded like dough but hardens on exposure to the air, is used in the manufacture of fine porcelain, in fulling cloth, for marking broadcloths, for polishing mirrors and giving lustre to marbles. It is likewise employed in the preparation of glazed paper, as a species of paint, as well as for diminishing friction.*

From the foregoing remarks it is obvious, that the terms soapstone and steatite are erroneously applied in this country. The substance so well known among us and so much used for fire-jambs and linings of furnaces is the potstone, whereas the true steatite is a very scarce substance in the United States; still the term soapstone has been too long in use with us to allow of a correction of the error, nor is it a matter of sufficient importance to justify the attempt. The word soapstone will therefore be employed in the way in which it is generally understood in the country.

A soapstone in order to answer the most valuable purpose as a fire-stone should consist as nearly as possible of talc. This is indispensable, not only on account of the infusibility required, but also of the freedom with which the stone should yield to the saw and chisel

* According to HUMBOLDT, a savage race on the banks of the Orinoco live for nearly three months in the year principally by eating this kind of talc, which they first slightly bake and then moisten with water.

of the manufacturer. The foreign minerals liable to injure the quality of the stone are rhomb-spar, hornblende, and magnetic iron. Of these, hornblende is by far the most abundant, and generally exists in the form of thin light-colored, almost capillary crystals, called asbestiform tremolite. This substance consists of silica, magnesia and lime; a compound which is quite fusible compared with talc, and one whose hardness is superior to that of glass. If the crystals attain any size, they not only operate injuriously by dulling the stone-cutter's instruments and by increasing the fusibility of the rock, but render it brittle and more likely to crack by heat. When these crystals on the other hand are mere fibres and scarcely discernible by the naked eye, they are much less prejudicial to the qualities of the stone and if not present in too great proportion, do not destroy its value.

It is very common to hear of soapstone beds in the southwestern part of the State; but none of them are fairly entitled to the name. The rock referred to under this name in Greenwich (461), Stanwich, Litchfield, New Hartford, Wilton and Colebrook (462) is entirely composed of asbestiform tremolite, and might with great propriety be called asbestus-rock, since in some of these places it forms extensive beds. All attempts to quarry and to slit it, must be attended with so much difficulty, that it can never come into competition with genuine soapstone. Rudely shaped blocks of it are used to some extent in furnaces, in the chimneys of smiths and for common chimney-backs.

A soapstone better entitled to the name, though not of the best quality (374), exists in Somers, where it has been quarried for many years. The quarry is on the eastern side of Durfee mountain, about one hundred and fifty feet above its base. It occurs with talc-slate in interstratified masses in hornblendic gneiss. It abounds too much in tremolite crystals, and grains of magnetic-iron, to admit of the most valued applications of this substance as a fire-stone; besides, it is injured by possessing too shistose a texture. The uses to which it has been applied are, for hearth and grave-stones, and for jambs. At present however, it is but little worked.

The chlorite of Newtown (375) is well adapted to the manufacture of ink-stands and similar articles, and has already been employed to some extent for this purpose. The true soapstone or

steatite is found at Bartholomew's factory in Bristol, and at two places farther south, where it exists in a limited formation of hornblendic serpentine, forming coatings and veins (376*y*). It possesses all the requisites for the purposes above described as pertaining to this substance, and it has already attracted the notice of tailors, who have found it possessed of the same properties as the French chalk of the shops.

VII. Materials for Alcaline and Earthy Salts.

Allusion has already been made under iron-pyrites to some indications of the existence of alum-slate in Connecticut. It may farther be mentioned that the alumina-sulphate of iron, sometimes alone and sometimes attended by alum, occurs as an efflorescence upon mica-slate and micaceous gneiss rocks at many localities in the State. The most remarkable instance perhaps, of the existence of these minerals is in Plymouth, three quarters of a mile from the Waterbury line and near the Naugatuck river. They occur coating the protected part of a high projecting ledge of mica-slate, and arise without doubt from the decomposition of iron-pyrites and mica. Under somewhat similar circumstances it occurs in Salisbury, Preston, Oxford and many other places. It is generally known to the people of the vicinity, and resorted to by them, for domestic use. Although no example is known of the use of a pyritous mica-slate for the formation of alum, there is every reason to believe that it would answer the purpose on being submitted to roasting and lixiviation, as well as the genuine alum-slate. The experiment is certainly worthy of being made at some of the places here enumerated.

Our formations are singularly exclusive of the soluble and sapid salts; and no hopes may ever be entertained of procuring common, epsom, or glauber's salt except from the waters of the Sound. The very rare and costly salt, borax, has not yet been detected in the United States; nor have we discovered the elementary acid of this salt in an insulated state, with which as it exists in Europe, borax is so easily made. Both borax and boracic acid are minerals thus far only found in volcanic districts. One ancient volcanic rock, the trap however, does contain an earthy mineral in which the boracic acid is present in the proportion of from twenty-one to thirty-five per cent. This mineral is the datholite. Its other ingredients are

silica and lime. This is decomposed by means of sulphuric acid; and the borax may be formed by adding carbonate of soda, and withdrawn from the silica and sulphate of lime, by crystallization. Should this method be attended with difficulties, a variety of others might undoubtedly be substituted with success. The quantity in which the datholite is found appears to authorize its being pointed out to chemical manufacturers as deserving of attention in this point of view. Its localities are numerous; and at some of them, it is quite abundant. The most important of these are Hartford, Southington, Middlefield and Berlin. The trap is every where its gangue, in which it generally forms small nests and geodes (390, 393, 394), though it sometimes, as at the Rocky Hill quarry, occurs in veins (391, 392). Should the localities of this substance already discovered be inadequate to the manufacture proposed, it is possible that others may be found where it is more abundant, since it appears to be a very frequent mineral in the trap. The importance of this salt in the working of the metals, in porcelain and glass-manufactories and as a flux generally, will attach a high value to the discovery of the materials for its production in our State.

A source of carbonate of potash (potashes) from feldspar, has of late been ingeniously suggested in Europe. The mineral is to be be calcined with lime, and after having been left for some time in contact with water, the liquid is to be filtered and evaporated. Feldspar treated in this manner, yields from nineteen to twenty per cent, and mica from fifteen to sixteen per cent. The china-stone quarry range of granite would afford the former of these minerals in the greatest abundance, while the latter might be obtained to advantage for this purpose at numerous places in the mica-slate ranges. It is not to be expected however, that this source of potash will attract attention so long as wood continues to be the principal fuel of the country. But it is gratifying to know, in the event of the substitution of coal and peat for wood, that this indispensable salt can be supplied directly from the mineral kingdom, and probably without any serious enhancement of price.

VIII. Materials for Bricks, Pottery, Porcelain and Glass.

The materials for the fabrication of bricks are every where abundant and of the best quality, throughout the secondary region of the State. They also exist to a limited degree, in some sections of the primitive; especially in regions of argillite and mica-slate. Information respecting this subject however, is too common and widely diffused, to demand any remarks in this general report.

It is a more important duty to speak of the resources of the State, for the manufacture of fine crockery and porcelain. When we consider how few countries are possessed of these, and bear in mind the heavy tax to which we are subjected for articles of foreign manufacture, it is surely a subject of just congratulation that we have within our own territory, every thing essential to the production of the finest fabrics of this nature. And though we have not yet commenced the manufacture of porcelain, it is gratifying to find that the country from which is received the most of our fine crockery, is already laid under an annual tribute to us, for the raw material of some of her most finished ware. It is hoped that the time is not far distant, when Connecticut will add the fabrication of porcelain, to the long list of arts she already so successfully cultivates, and imitating the example of the French nation, be able to supply herself with articles of durable porcelain even for common use, in place of the flimsy and sometimes deleterious wares, for which she is at present so exorbitantly taxed.

The discovery of porcelain-clay in New Milford was made about thirty years ago, by a goldsmith; who first employed it, in the fabrication of crucibles. It is situated three miles west of the village, forming a bed whose extent has not been fully explored, upon the western slope of an elevated range of granitic gneiss. The clay has been dug, over an extent of several acres; although the principal pits are near each other, and contiguous to a ravine through which flows a small stream. In many places the decomposition of the parent rock is so complete, as to present the aspect of a secondary deposit; but the prevailing appearance is that of the rock altered in place, through the decay of the feldspar and mica. Indeed, the same relative arrangement of the quartz and the altered feldspar is observed in the bed, as is presented by these materials in the undecomposed

rock (418, 419). Veins and seams of a perfectly impalpable and white clay (420) traverse the bed in various directions, analogous to veins of feldspar in the granite of the neighborhood. The only use hitherto made of this clay has been, the fabrication of the common domestic porcelain-furnace, and of fire-brick for anthracite-furnaces. One of the proprietors of the bed (Mr. L. HINE) has carried on this manufacture for upwards of eight years, giving employment to five or six hands. A second manufactory still more extensive, was established in the same place two years ago by Mr. ANAN HINE, who is a joint proprietor in the same clay-bed. The products of both these establishments amount the present year to about $6000; of which $1000 is in portable kitchen-furnaces, and the balance in fire-bricks. These last enjoy a very high reputation. They are largely employed in the Olmsted anthracite-stoves, for furnace-linings, in brass-kettle manufactories, and in puddling furnaces. The price is about two-thirds that of the Stourbridge brick, which they nearly equal in their refractory properties. The clay selected for their manufacture is the variety abounding in small quartz-grains, and which at the same time, is as free as possible from ferruginous stains. The material is quite different from that which affords the English brick, although it is no doubt capable of yielding a very superior article.*

Similar clay has been observed between this bed and Sherman, though where it has been opened it appears somewhat stained with iron (423). But a bed of very pure and white porcelain-clay (423*b*) exists in the south part of Kent, about two miles east of the Housatonic, on Mr. R. PEAT's land. It forms a vein of many feet in width, cutting through quartz-rock. It owes its origin to a graphic granite, which must have been free from mica. Trial was made of it at the Jersey-city manufactory a few years since, and its quality is said to have been excellent. The cost of transportation however, was found to be too great to permit its use in that establishment. A partial vein of the same substance is known in the southeast part of Cornwall, on the land of Mr. STEPHEN CURTIS. It is less pure

* The Stourbridge clay is found in the Staffordshire coal-field, beneath a stratum of coal and of mixed materials. When first raised, it is almost of a stony hardness and of a leaden or gray color. It soon crumbles to dust on exposure to the air, and is easily softened and tempered with water.

than that of Kent, containing frequent crystals of black tourmaline. Besides, the feldspar is far from being completely decomposed.

A feldspar admirably adapted to the purpose of forming a glaze to porcelain-ware,* has within a few years been discovered in the south-eastern part of Middletown. Its application was first suggested by Dr. BARRATT of that place. The quarry is situated in an extensive range of granite, distinguished for the whiteness of its feldspar and for the unusual size of the individuals in which it occurs,—masses sometimes occurring of several hundred pounds weight, without any admixture of quartz or mica. In some parts of the quarry albite, a mineral whose composition scarcely differs from that of feldspar except in the substitution of soda in it for potash, is intimately blended with the feldspar,—its existence being distinguishable only by the superior whiteness of color and pearliness of lustre which it possesses (411). The situation of the quarry is favorable for being easily worked, and it is capable of supplying an unlimited quantity of the material. Seven hundred tons were delivered at Middletown

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* The applicability of decomposed feldspar, or of porcelain-clay, to the manufacture of porcelain depends on its loss of the alkali it contained previous to its decomposition. In consequence of this change, the articles into which it is moulded become capable of withstanding fusion in the intense heat of the furnaces, becoming only semi-vitrified, or converted into what is called biscuit-ware. In this condition their surface is not smooth, nor are the articles impermeable to water. They require to go through the process of glazing or enamelling, whereby a composition which is applied to the surface may be completely fused and incorporated with the body of the ware, at a heat which will not soften the articles or in any manner affect their shape. In common kinds of ware the glaze is composed of powdered gun-flint, litharge and common-salt, the disadvantage of which process is, that the enamel is so soft as very soon to yield to the knife and other agents to which it is subjected in common use; and besides, the rapid destruction of the ware, the oxide of lead it yields is sometimes injurious to the health. In the most superior manufactures however, the enamel is derived almost wholly from pure, undecomposed feldspar, which in consequence of the alkali it contains, forms a colorless glaze without the addition of any deleterious substance. It simply requires to be reduced to powder and diffused through water with a litle borax to the consistence of cream, to prepare it for application to the biscuit-ware. The articles to be glazed, after immersion in this paste, are subjected to the heat of the furnace, whereby they become coated with an enamel harder than glass and unalterable by acids, alkalies, and all other agents to which they are commonly exposed. By mingling pulverized feldspar with porcelain-clay, or the purer varieties of potter's clay, a basis for the common kinds of earthern-ware is obtained.

last year, of which six hundred were shipped to Liverpool, and one hundred to the porcelain-factory at Jersey city near New York.

The same coarse grained granite in which this quarry occurs, is spread over an extensive district, proceeding in a northeasterly direction with tolerable continuity, in high and broken ledges to Roaring brook in Glastenbury. It can scarcely be doubted therefore, that other places will on proper search, be found within this formation equally productive of this precious material.* A spot in particular, between this quarry and Maromus, on land of Mr. Chase and adjoining the road, appeared to offer very encouraging appearances of this mineral.

A vein several feet wide, of a very soft unctuous clay, was discovered in digging a cellar in Greenwich, near the inn of Mr. A. Lyon. The same vein has been noticed in several other places, one of which is half a mile distant. Its first appearance is that of porcelain-clay. It lacks however some of the properties of that valuable substance. Its unctuosity when rubbed between the fingers is unusual, and its odor is scarcely at all argillaceous. Grains of quartz and feldspar are diffused through its mass. After drying, minute laminæ of talc, or of decomposing mica become apparent, and the addition of hydrochloric acid produces slight effervescence. The only trial thus far made of it was in the chimney of a blacksmith's shop. It was employed as mortar in the brick-work about the fire; and is said to have proved very refractory. It may still be doubted, however, whether it will be found valuable in the manufacture of porcelain: it might prove useful in the fabrication of coarse furnaces and of fire-brick.

A limited bed of porcelain-clay was discovered several years ago in the northwestern part of Granby. Its quality was found to be good by Prof. Silliman, to whom samples were submitted for examination; but the quantity in which it occurred was insufficient to excite any expectations of utility. Favorable indications of the same material are said to have been observed in digging a raceway

* It is an interesting fact, that the china-stone rock of England is that in which the tin mines are found; and since we have already detected several of the rarer metals in the Middletown quarry, it is by no means impossible that this great desideratum with us may yet be realized. The finding of titanium and uranium imbedded in the china-stone is a singular coincidence also, since the only use of these metals is for staining porcelain.

in Bristol, three miles southwest of the meeting-house at Johnson's mills.

Sand.—It is an object of some importance to ascertain the existence of particular varieties of sand adapted to the different purposes of the glass and porcelain-manufacturer, as well as for the construction of moulds in brass and iron-founderies. But a single deposit of sand suited to the fabrication of plate and flint-glass, attracted particular attention during the survey. This occurred on the shores of the Quosipaug pond in Middlebury. It (331) consists almost exclusively of quartz, the grains of which are colorless and transparent. From its great purity, it must be equally adapted to the wants of the porcelain-manufacturer. A bed of sand suitable for inferior kinds of glass exists in Eastfield, on the Providence road and half a mile west of the Rhode Island boundary. It (325) is in very fine grains and of a light color, though less free from foreign substances than that above described. The sand resulting from the decomposition of the Stafford fire-stone, a micaceous quartz-rock, would be found very serviceable for moulds in iron or brass-castings. It gives rise to a very fine, unctuous and infusible sand, and would no doubt be valuable also in glass-making.

IX. Fire-Stones.

Under this name are included those refractory stones which serve for the linings of furnaces, used in the smelting of ores and the fusion of metals. All the requisites in a stone destined for this use are rarely found. Such stones must not only be infusible, but must not be liable to crack or exfoliate. The presence of lime or magnesia unfits them for this application; if they consist wholly of quartz they crack when heated, or if there is an excess of any fusible mineral, they are converted into a glass. The stones most commonly employed are quartzy graywackes, micaceous gneiss, mica-slate and steatitic or asbestus-rocks. In the iron-works in the neighborhood of Salisbury, mica-slate is employed for the inner wall of the furnace, and red sandstone from Haverstraw on the Hudson, for the hearthstone. Trial has lately been made of a shistose quartz-rock (181*b*) found in Sharon on Mr. Abel's land, two miles south of Lime-rock, for furnace-linings, and the result is very promising. In the eastern part of the State, quartz-rock (172) has been used to some

extent; while at Stafford a stone of intermediate quality, a micaceous quartz-rock (171) is preferred to all others. As this last mentioned rock enjoys a very high reputation, and is beginning to be extensively used as a furnace-stone, it demands a somewhat detailed notice. The quartz is arranged in laminæ of such thinness, that it requires at least fifty repetitions of them to form an inch. Each layer is completely coated with an almost unbroken film of white-mica. The rock cleaves with the utmost facility, and perfectly strait. The layers of quartz, moreover, are made up of slightly cohering, transparent grains, in consequence of which structure the rock is a very weak one, and may be broken with a slight force even in slabs of considerable thickness, and it may be cut and dressed on the edges with much more facility than the softest sandstone. It occurs at the quarry in strata nearly vertical; and is shaped into blocks two feet square on the broadest face by sixteen inches thick. In this condition it sells for sixteen dollars per ton. The demand for the stone at present is sufficient to afford constant employment to two quarrymen. The blocks simply require to be so arranged in furnaces as to have their edges perpendicular to the surface of melted metal. Some of these fire-stones at the furnace in Stafford after they had been subjected to this use, were observed to have undergone a semi-fusion only, even where they had been exposed to the most intense heat. The silica on the exterior of each siliceous lamina had apparently been adequate to the saturation of the earthy bases contained in the mica, leaving the centre unaffected; while the glass produced, had on the whole been sufficient to convert the stone from a friable, into a closely agglutinated mass. Those fragments and masses of the rock not adapted to use in furnaces are reduced to sand, and employed to some extent along with lime, in the preparation of a handsome finish for the walls of rooms.

X. Fluxes.

The term flux denotes any substance added to assist the fusion of minerals. The number of different fluxes, simple and compound (some of which are metallic, but the greater part unmetallic) employed is very great. Of these, but a small number have been used in the large way in this State, in the treatment of iron and copper-ores.

The great flux in use for the treatment of iron-ores is limestone. Its operation depends upon the presence of silica and alumina intimately blended with the ore, which in the white heat of the furnace form with the lime a light fusible glass that rises to the surface of the fluid contents of the furnace, and is from time to time, withdrawn. Several of the iron-furnaces in the western part of the State make use of dolomite instead of limestone, and it admits of very well grounded doubts whether a considerable loss is not thereby sustained in the fluxing of their ores; for there is a very material difference between these two species in their composition. The first consists of lime 56 and carbonic acid 43, whereas the last consists of lime 30·5, magnesia 22·1, carbonic acid 47·2. It requires nice observations to distinguish these species from each other; and there are cases in which the two are intimately blended. For the purposes of architecture, or for common mortar, the difference is not so important; but as a flux, the distinction is one of some consequence. In the case of fluxing iron ores, it must be borne in mind that in the process, the scoriæ and glasses produced are definite compounds of silica (silicic acid) with such bases as may be present (lime, alumina, magnesia and oxide of iron), and that among these compounds there is a wide diversity as to fusibility as well as in the quantity of the metal which they withdraw from the product of the operation. It hence becomes important to add the right kind of flux and in correct proportions, if we would have the earthy matters rise with facility and without impoverishing unnecessarily the yield of metal. When dolomite is used, magnesia is added compared with lime, in the ratio of 22 to 30. Such an addition is undoubtedly very injurious. There are some ores analogous to those of Salisbury requiring a flux of clay and limestone within certain proportions, as silica from 40 to 60 p. c., lime 20 to 40 p. c. and alumina about 20 p. c.: others again require pure limestone. None are known in which magnesia can be employed advantageously except it be in small quantity; for metallurgists have ascertained that an excess of magnesia greatly diminishes the fusibility of the scoriæ, and interferes with the free working of the furnace. The majority of the furnaces in the Salisbury region employ dolomite instead of limestone. This is the case with the furnaces at Bull's bridge, at Kent, and New Preston; while those of Mt. Riga, Limerock and

Cornwall, employ a flux which consists of a mixture of dolomite and limestone, but in what proportions has not been ascertained. The subject is worthy the attention of iron-masters, nor will it probably be difficult to find beds of pure limestone associated with the dolomite in the region of most of the furnaces, though it was not detected in ascending the Housatonic before reaching Cornwall; here a mixture of the two species began to prevail, and continued into Canaan. With proper care a flux of sufficient purity can no doubt be had in the vicinity of Canaan falls.* Whenever the spathic iron of Roxbury is worked, it will be unnecessary to add any flux, as the silica of the vein-stone which will adhere to the ore will doubtless prove sufficient for its proper fusion. This will depend, however, upon the quantity of manganese the ore contains. Should magnesia preponderate over manganese, the ore will demand a large dose of limestone as well as of the vein-stone,—of the two taken together a weight equal to half the ore, and in this process, it will be essential to avoid dolomite.

The Phenix Mining Company procured a small quantity of the magnetic iron-pyrites from Litchfield, and of fluor from the topaz-vein in Trumbull, with the view to employ them in the smelting of the copper-ores of Granby, which are contained in siliceous sandstone. How far they have been able to use these fluxes to advantage is not known; but fluor is a valuable agent to employ in the case of silicates in ores, since during their fusion together, a portion of the silica is expelled by the union of its basis (silicon) with its radical of fluoric acid (fluorine), to form the fluo-silicic acid, which is a gaseous product. The proprietor of the topaz-vein supplied a considerable quantity of the fluor for the purpose just alluded to, at sixty dollars the ton. Should other copper-mines be wrought in this country to any extent, it is probable that this deposit of fluor will become highly valuable, as it is the only one in this part of the United States capable of affording it in quantity. It may also be used advantageously in fluxing some ores of iron.

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* The most convenient mode of detecting a pure limestone is to pour on a few drops of dilute nitric or muriatic acid to a freshly detached mass of the rock: if the effervescence is brisk (similar to what it would be on chalk) it is a pure limestone, whereas if it yields but a few bubbles, it is dolomite.

XI. Quick-Lime and Water-Cement.

Any rock containing enough of carbonate of lime to slack with heat on the addition of water after calcination, is called by people in general a *limestone*, and is capable of being employed as a source of quick-lime. The effect of the calcination is to expel the carbonic acid, which in a pure limestone, is present in the proportion of forty-four per cent. The products of calcination however, will differ according to the foreign materials in the limestone. We may accordingly be said to have in the arts, three principal kinds of quick-lime: viz. pure lime, magnesian lime and hydraulic lime. The first of these is produced by the burning of pure limestone, i. e. where the carbonate of lime is present in a proportion not lower than eighty-five per cent., the remainder consisting of magnesia, alumina, the oxides of iron and manganese, and of silica. The magnesian lime is the product of rocks in which carbonate of magnesia is associated with the carbonate of lime in a proportion, between fifteen and forty-five per cent.* Hydraulic lime is derived from rocks containing between ten and thirty per cent. of clay (a mixture of silica and alumina in nearly equal proportions). These varieties are essentially different from each other. The two first are alike adapted to atmospheric uses; the last, as its name signifies, to subaqueous applications,—having the extraordinary property of hardening under water.

The pure and the magnesian limes differ from each other in several important particulars. The pure lime is burnt the easiest, slacks with the greatest violence, and is reduced to an impalpable powder or to a perfect magma (according to the quantity of water added); whereas the magnesian lime slacks with less extrication of heat, produces a powder not so impalpable (often being resolved partly into small grains of the size of broken rice), and with excess of water yields a less perfect paste. The pure lime again is superior to the

* When carbonate of magnesia is present as high as forty-five per cent., the rock is pure dolomite, which is a double salt of carbonate of lime and magnesia; when in less proportion, it is a mechanical mixture of dolomite with carbonate of lime (pure limestone). Dolomite is sensibly harder under the knife than pure limestone. It is also slightly heavier. With dilute nitric or muriatic acid, dolomite in the unpowdered state scarcely effervesces, whereas pure limestone boils briskly. Intermixtures of dolomite and pure limestone exhibit intermediate properties in these respects.

magnesian in its caustic or alcaline effects. A still more important difference between the two, relates to their fitness for agriculture : the pure lime on a majority of lands is an amendment of the highest value, while the magnesian lime is said to be positively injurious, at least for a considerable time after the dressing has taken place, and consequently is not employed as a manure. In their fitness for mortars and cements, the magnesian lime appears to enjoy the preference, both as to the strength andthe hardness of the work. It likewise has greatly the advantage in whiteness, and appears to be capable of taking up the most sand in the formation of mortar.

Connecticut affords the three kinds of lime just enumerated. The magnesian lime however, is by far the most abundant. It is moreover of the strongest kind, being derived from the pure dolomite. On account of its very superior whiteness and the excellent mortar it forms, it enjoys a decided preference over the pure lime. Whether it would continue to do so to the same degree as at present however, were equal pains bestowed npon the burning of the better quarries of our pure limestone, admits of a doubt. The hydraulic lime does not require the enumeration of its distinctive properties.

The following is a list of the principal kilns for the production of the three kinds.

1. *Magnesian Lime.*

Hill's Kiln in Reading.—This quarry enjoys the highest reputation of any in the State for the quality of its lime. The rock is large grained and remarkably white (351*y*). Mr. HILL burns twelve kilns of twelve hundred bushels each, annually. Forty cords of wood are required to a kiln, and the burning lasts for six days. It sells for two dollars and an eighth per cask of three and a half bushels, at the kiln.

Wildman's Kiln in Brookfield.—This kiln holds but seven hundred bushels. It is burnt several times in the year. The quantity of wood consumed is thirty-five cords to the kiln, and the burning lasts eight days. Its price is ten shillings the cask, the barrel being returned.

Chapman's Kiln in Ridgefield.—Mr. CHAPMAN burns two or three kilns only each year. The size of his kiln is the same as that of Mr. WILDMAN'S.

Mead's Kiln in Ridgefield (348).—This kiln was not in operation when visited in 1835.

Camp's Kiln in Washington.—Mr. CAMP burns a few small kilns only, each year.

Peat's Kiln in Washington.—This kiln was supplied from the marble-quarries. It is not now in operation.

Kiln between Kent and Cornwall, on the Housatonic.—A small kiln, which is only burnt occasionally.

Canaan Kiln.—Reference is here made to a kiln situated half a mile north of the post-office. Other kilns exist in this town, but whether they afford magnesian or pure lime is not known.

Geer's Kiln in North Stonington (218).—This kiln holds but three hundred and fifty bushels. It has not been burnt for several years.

Greenwich Kiln.—A small kiln not at present in activity, exists in the northwest part of Greenwich.

2. *Pure Lime.*

Bassett's Kiln in Derby.—It is situated directly on the Housatonic, three and a half miles above Derby bridge. The kiln holds two hundred and seventy bushels, and is burnt once a fortnight during several months in the year. The burning is kept up for five or six days and consumes from eight to ten cords of wood. The lime sells at forty-five cents per bushel at the kiln. In whiteness, the lime is inferior to that of Reading, nor has it attracted attention as a remarkably strong lime, although it is derived from a very pure limestone (342, 343). Whether this is to be accounted for on the ground of want of observation in those who use it, or from an imperfect calcination of the limestone, it is impossible to decide: as likely to be connected with the latter cause however, it may be remarked that the furnace is exceedingly defective in its construction.

Quaker's Farm Kiln.—This quarry, situated a few miles above the last mentioned, affords a pure limestone; but owing to the difficulty of raising it from its bed, it is now nearly abandoned.

Bidwell's Kiln in Watertown.—It has not been burnt for the last fifteen years. The limestone is very pure and white (345, 378), and though abundant, yet from the manner in which it is interstratified with granite, the quarrying of it will be attended with considerable expense.

Welton's Kiln in Watertown.—This kiln is situated on the west bank of the Naugatuck, one mile and a quarter below HENRY TERRY's factory in Plymouth. It is not in operation at present. The limestone is abundant and accessible.

Wells' Kiln.—Situated one mile and a half southwest from Zoarbridge.

Shelton's Kiln in Monroe.—Preparations are now making to burn lime at this quarry.

Kiln in Trumbull.—It is in the vicinity of the topaz-vein, but is not in operation. The limestone is abundant at this place, though rarely free from imbedded minerals, such as mica, pyroxene, hornblende, &c.

3. *Hydraulic Lime.*

Southington Kilns.—It is now upwards of ten years, that hydraulic lime has been prepared in Connecticut. The greater part of it is furnished by the town of Southington. The quarries are situated near the line of Berlin in a narrow band of shale, between trap and amygdaloid. The rock occurs in thin, nearly horizontal strata, alternating with clayey marls and shales. It is nearly compact, earthy, and somewhat bituminous. On exposure to the weather it loses its glimmering lustre, becomes softer, attended with development of oxide of iron (291). To prepare it for use, it is partially burnt in small kilns so as to render quick a considerable part of the lime, after which, it is ground in mills like plaster. The quantity annually supplied by the town of Southington, does not fall much short of five hundred tons. Kilns of the same rock are occasionally burnt at South Britain, (Southbury,) where an abundance of the material likewise exists. The coal-digging in Durham affords the hydraulic limestone, and under circumstances of great convenience as respects the contiguity of wood and water.

Elliot's Kiln in Northford.—This is a bed of compact gray limestone (296, 296*b*, 297*b*), contained within the secondary, and contiguous to trap. The bed is extensive, and presents an obscure slaty arrangement. It is cavernous, or amygdaloidal in its structure; and is raised without the aid of blasting. It is burnt for the common purposes of quicklime in a kiln holding about five hundred bushels. This quantity is burnt once or twice each year. It is not a white

lime, and is said to slack slowly; but when carefully prepared by the mason forms an excellent mortar. As the calcined limestone consists in the hundred, of lime 82, silica, alumina and oxide of iron (together) 15, and magnesia 3, it is obvious that this deposit is well adapted to the fabrication of hydraulic lime. Its constitution fits it also when burnt as at present, for entering into the composition of stucco-work, and rough cast-finish.

Pure limestone as well as dolomite, are both extremely scarce throughout the whole eastern half of the State. It is probable that the bed of dolomite in North Stonington may be found extending itself for a few miles, both in a northerly and southerly direction from Geer's kiln, but beyond this no indications of limestone appear except in the mica-slate of Bolton mountain. At the notch in Bolton, several thin beds of pure limestone (219) make their appearance, and the same strata occur again nearly two miles north in the flagging-stone quarry in Vernon (347*b*). The overlie of the flagging-stone here, for a thickness of thirty feet, chiefly consists of a calcareous mica-slate, in some layers sufficiently rich in carbonate of lime to be burnt for agricultural purposes, if not for the fabrication of mortar. The same stratum is no doubt continuous through the range, and in some part of it may be still richer in lime.

The western part of the State on the other hand, is in general well supplied with the varieties of calcareous rocks, although the dolomitic kind greatly prevails. Still even within the dolomite, it is believed that extensive beds of pure limestone exist. This is known to be the case, particularly in the towns of Brookfield and Danbury. Beginning a little northeast of the lead-mine, a belt of nearly half a mile in breadth, including the mine, passes off in a direction towards Danbury for two or three miles. It was formerly burnt at Banks', two miles south from the lead-mine, and at Williams & Benedict's quarry, one mile and a half northeast from Bethel. Indications of a bed of pure limestone also, were noticed a little west of the Danbury meeting-house. A bluish granular limestone in Canaan near the falls, seems likely to be sufficiently free from magnesia to make a pure lime. The samples examined from Limerock in Salisbury, evidently consist for the most part of pure limestone. These deposits and many others, which careful examinations in this region will undoubtedly bring to light, are entitled to special regard, provided the

distinction between pure and magnesian lime, above pointed out, are well founded.

The Trumbull and Derby region of lime contains no dolomite. The beds in this quarter are doubtless much more numerous than has been imagined. One well adapted to being wrought near Humphreysville, on the road to Oxford, has not hitherto attracted attention. It is situated on a hill near Little river, a stream on which are located several small iron-manufactories. The land is owned by Mr. WASHBURN. The limestone crops out at two places. It is connected with granite beds in gneiss, and will undoubtedly prove abundant and of excellent quality. Dolomite is also wanting in the Watertown beds of limestone. This likewise is a region of great importance as a source of pure lime. Indications of a good limestone are frequent in the north part of Milford, particularly on land of Mr. ENOCH CLARK. The green marble of the Milford quarry has been burnt into lime. Its foreign ingredients however, were too abundant for the production of a quick-lime adapted to general use. Moreover, its dolomitic character would prevent its application to agricultural purposes. The argillo-micaceous limestone in the north-east part of Woodbridge (168), and a similar rock cropping out in the argillite by the road-side on the Litchfield turnpike, near the house of Mr. T. J. PERKINS (167), is worthy of the attention of the inhabitants in that vicinity. As the limestone is free from magnesia, it would be well worth burning for the benefit of lands, and might subserve a valuable purpose as an hydraulic lime. Some of the beds at these places abound in iron-pyrites, and are consequently prone to decomposition. Such strata, if broken up and scattered upon the land without burning, might be found serviceable; as the change it would undergo from exposure, must result in the gradual formation of gypsum.

Before concluding the present section, public attention should be invited to more economical methods of burning lime. Fuel is becoming so scarce throughout the State, that unless radical improvements are made in the lime-kilns, the use of lime on land it is to be feared can never obtain to that extent with us, which it has done in all those countries where agriculture has attained its highest perfection. Many of the furnaces for burning lime in the State are faulty in their shape, and often unprovided with grates. No perpetual

kilns are in use. The limestone is introduced in pieces much too large. The time employed and the fuel consumed in the burning of a kiln, are unreasonably great. In Pennsylvania, and in some parts of New York and Ohio, a kiln is burnt in forty-eight hours. When the burning is over however, the furnace is completely closed up for a week, whereas the average time of burning in Connecticut is a week; and here no attention is paid to stopping the passage of cold air through the furnace when the burning is completed. The perpetual kilns of Pennsylvania yield seven hundred bushels of lime for every eight cords of wood and one ton and a half of anthracite, consumed. In New York, two thousand bushels of lime are burnt with twelve cords of wood. The use of anthracite coal might be availed of to great advantage in the quarries of the Derby region, and will no doubt come into extensive use in Brookfield, as soon as the contemplated rail-way between Bridgeport and New Milford is completed. It is not however fully ascertained, whether the limestone which is calcined by anthracite affords a quick-lime so well suited to the fabrication of mortar as that produced in the old way. The quick-lime furnished by the anthracite-kilns of Pennsylvania, and which is derived from pure limestone, is said to take up only three and a half times its bulk of sand in the formation of mortar. Peat likewise might be used in this State for the calcination of limestone to great advantage. It is extensively employed in Europe with the highest success. Lime is in this way produced with only twice its volume of this cheap combustible.

XII. Stone-Paints.

The practice of substituting the powder of certain soft minerals for the metallic pigments, is comparatively modern. There is an extensive mill for the manufacture of these lithic paints at Miannus (Greenwich), where fifty tons were prepared during the year 1835. The stone to which the preference is given is soapstone; and the supply is chiefly derived from the refuse-fragments of the stone-cutters in New York. The asbestus-rock of Stanwich is used to to some extent, as also the serpentine of Hoboken, (N. J.) These minerals are ground with whale-oil, in which condition the paint is sold at five dollars the cwt. It is said to answer a good purpose, especially for the roofs of houses. Two coats of it are found to form an excellent basis for a single coat of common paint.

Mr. E. D. Godfrey has lately commenced the grinding of talcose-slate (212) in Wilton. The rock is not abundant, though apparently of a good quality for this purpose, being both soft and light colored. The veins of heavy spar (sulphate of barytes) in the sandstone of Cheshire, are also beginning to attract attention with a view to a lithic paint. This species has already been employed successfully in Europe in the composition of lithic paints, and its use with several important modifications, has been introduced by Mr. Forrest Shepherd, into this country. It may certainly be said to approach very near to white-lead in purity of color and weight; and even surpasses it in inalterability. The difficulties to be met in the use of stone-paints, are doubtless connected with their want of affinity for oils and the impossibility of reducing them to a state of comminution comparable to that of white-lead. This last mentioned defect will be obvious to every one, who reflects upon the great difference which must always exist between the finest powder obtained by mechanical means, and those insoluble precipitates which result from chemical combination.

XIII. Decolorizing Carbonaceous Slate.

A bituminous slate found at Menat in the Puy-de Dôme (France), has lately been applied most unexpectedly, to a valuable purpose as a decolorizing agent in place of animal charcoal. It occurs in thin layers and sometimes in considerable masses. It contains the impressions of fishes and traces of vegetable remains. Its color is yellowish or blackish gray. It is fragile, easy to pulverize, burns with flame, and leaves a residue of a red color, which constitutes a true tripoli. To prepare it for use, it is burnt or charred in kilns like charcoal. After having gone through this process its color is changed to black, the slate becomes harder, but is still easy to pulverize. It is now suited to the clarification of liquids, and has been found to answer a purpose equally valuable, if not more so, than animal charcoal. Care is taken in the selection of the slate to avoid those pieces which are penetrated by iron-pyrites, as the sulphuret of iron if intermingled with the decolorizing material, is apt to stain prejudicially the syrups of sugar.

The bituminous slate excavated in examinations for coal half a mile northwest from Rocky Hill, in Wethersfield, (277*b*, 278) pre-

seats so strong a resemblance in its properties with the description above given as to lead to the hope, that it may be found to possess the same valuable property. The ichthyolite-bituminous slate of Durham (278*b*) deserves to be mentioned as worthy of examination with the same view.

XIV. Materials for Architecture and Decoration.

Materials for architecture and decoration are very naturally distinguished from each other. To the first, belong all such as without particular regard to their color, possess the strength and indestructibility required in the materials of large buildings and heavy constructions, and such as at the same time are found in sufficient abundance and under such circumstances as not to render their quarrying too expensive; while to the latter belong those rocks and minerals of more limited extent, but which are possessed of delicate colors, and such as in general from their texture and hardness, admit of, and retain, a high polish.

Materials for Architecture.—Several properties are essential to constitute a good building material. Of these, strength is undoubtedly the first requisite. The material which under a given volume will sustain the greatest weight, is the best. Numerous experiments have been made upon the various kinds of rocks, with a view to determine this point. The following table illustrates the difference which experiment has decided to exist, among a few of the most common building stones:—

Basalt, - - -	51
Porphyry, - - -	50
Red Egyptian granite, -	20
Black marble, - -	19
White statuary marble, -	8

The next general requisite is, inalterability from the external agents of air and moisture. Many rocks which are firm when first quarried, become weak on exposure to the air; and others again, when they are subjected to the moisture of underground situations. It is also an important recommendation of a building stone, if it can sustain a high heat without suffering disintegration. Other considerations will demand attention according to the use to be made of the building material; as whether it be for splendid edifices, or for ordinary

structures as ware-houses, fortifications, bridges, stables, &c. In the former case, agreeable shades of color and freedom from materials which cause stains on exposure to the air will be taken into the account; while in the latter, these considerations will be unimportant. In the latter case again, it is desirable to find quarries capable of furnishing them without the use of gunpowder, and where they demand but little labor in shaping them for use. A degree of porosity is also a recommendation; since, besides rendering them lighter, it permits the mortar to bind them together more securely, and fits them to receive with advantage the stucco-finish and water-cement.

The building stone of Connecticut, both ornamental and common, must be regarded as constituting one of the most valuable resources of the State, whether considered as affording a supply to its own wants, or materials for exportation. The principal kinds at present in use are granite (the term being used in its widest sense), gneiss, sandstone, marble, sandstone-conglomerate and trap. The two last mentioned are only employed as a common building material.

The ornamental granite found in the State presents numerous varieties; in treating of which, it will be convenient to refer them to several general types under distinct names. 1. *Gray granite.* A fine grained rock whose materials are intimately blended together,—the feldspar (or the albite) and quartz forming a grayish white base (sometimes tinged with blue or yellow), through which minute scales of dark colored mica are more or less thickly sprinkled, having their broadest faces to some extent arranged in a parallel direction. This is the most widely diffused, and the most generally employed, variety of granite in the State (40, 41, 42, 42*b*, 43, 44, 46). 2. *White granite.* This differs from the gray granite in the preponderance of feldspar or albite (or of both) over the quartz, the mica being wholly wanting (32), or of a light color (25, 37, 51*b*). 3. *Flesh colored granite.* This is a granite of distinct individuals of feldspar and quartz with but little mica, the feldspar having a flesh-color with a shade of gray (1, 2, 2*b*, 44*b*, 46*b*, 47*b*, 45, 49*b*). 4. *Red granite.* A coarse grained granite in which the feldspar is deep red (13*b*). 5. *Epidotic granite.* This rock is fine grained, with a light colored basis of feldspar, quartz and epidote, through which is disseminated particles of a shining black mica (60, 61, 62, 63). 6. *Porphyritic granite.* Of this rock there are two varieties, the green and the gray.

(*a.*) *Green porphyritic granite.* This rock has a basis analogous to the epidotic granite, except that it includes a fine grained dark colored chlorite. Through this base is disseminated middle sized individuals of feldspar, either of a flesh-red, (53, 54) or of a white color (51, 52). (*b.*) *Gray porphyritic granite.* A rock with a quartzo-micaceous basis, through which are disseminated distinct individuals of white feldspar, either large (55), middle sized (56), or small (50); in the last case, the rock is scarcely distinguishable from gray granite. 7. *Chloritic granite.* This is a rock apparently peculiar to our region, and presents two striking varieties, at least as respects the color of the chlorite and of the feldspar. (*a.*) *Black chloritic granite.* This would pass for a sienitic granite unless subjected to close examination. Instead, however of hornblende, we find the black patches (107, 108) to consist mainly, of an intimate mixture of dark colored mica and chlorite with very little hornblende. Little or no quartz is present, and the feldspar is of a grayish white color. The rock is extremely tough. When moistened with the breath, it emits an argillaceous odor. (*b.*) *Green chloritic granite.* If the last rock is liable to be mistaken for sienite, this is nearly as much so, for some variety of chloritic marble. The feldspar has a grayish purple color, while the chlorite, which is also in little patches, has a dark leek green color, and imparts the prevailing tint to the rock. It is destitute of quartz, and emits an argillaceous odor on being moistened. 8. *Sienitic granite.* This rock contains but little quartz,—consisting almost entirely of feldspar and hornblende. 9. *Pseudo-sienitic granite.* The variety thus denominated is a gray granite, through which a black mica is disseminated in patches, imparting to it the aspect of sienite.

Of these varieties, the gray granite is by far the most abundant. Its geological repository being gneiss, the prevailing rock of the State, it is found throughout this formation in the form of beds, veins and interstratified masses, as well as in blocks, dispersed through the diluvium,—its greater hardness and freedom from iron-pyrites than the rocks which inclosed it having preserved it from decomposition. There are districts indeed in which it is less abundant than could be wished, even for supplying the limited wants of the people; while in regions where it does exist, comparatively but a small number of its quarries have as yet been successfully wrought. That of Millstone

point in Waterford, and which is directly at the water's edge, is the most extensively worked quarry of granite in the State. It employs about twenty men. The rock possesses an obscure horizontal cleavage, which occurs at intervals from one to three feet. It is wrought by drilling perpendicular holes near each other in the line of direction, in which it is desired to split it, into which iron-wedges are simultaneously driven. In this manner, blocks ten or fifteen feet in length, can easily be detached from the bed. The rock of this quarry is a firm and elegant building material, and has but a single defect that is in the least calculated to limit its use. This depends upon the occasional presence of minute crystals of iron-pyrites, which impart to faces of the stone after long exposure to the weather, a rusty appearance. This effect is visible at the quarry wherever the fissures and cleavages in the rock have admitted air and moisture. Portions of the rock thus stained, are called by the workmen, *sap*. Fortunately however, the iron-pyrites is not disseminated through the whole quarry, and in no case does it exist in such quantity as to weaken on its decomposition, the strength of the rock. Wherever this stone can be employed in sheltered situations, the sap will not make its appearance; and for those parts where ornament is not consulted, as in the foundation and rear of buildings, a superior granite cannot be found. As the quarry covers but a few acres of ground, and is but fifteen or twenty feet above the Sound, it will be exhausted in ten or fifteen years at the present rate of working. A bluish gray granite (43*b*) has been explored to some extent at Portersville on the Mystic, about sixty rods above the bridge. Present appearances would seem to promise a valuable material at this place; though the quantity cannot be very great, and considerable expense must be encountered in quarrying it. A fine grained blue granite (42*b*) has recently attracted attention near the stone-quarry on land owned by the heirs of Mr. Samuel Stanton. Several blocks of large dimensions have been dressed for use, in the village of Paucatuck. It remains to be seen however, whether the extent of the bed is such as to entitle it to much regard.

Mine-hill in Roxbury has been much resorted to, for a more shistose and lighter colored granite than that just described. It is easily obtained in very large tabular blocks, and might with as much propriety be embraced under flagging stones, as it is employed for

paving, as well as for building stone. Its leading use however, is for underpinning and for stepping stones. At present, it employs but two or three hands. A similar use is made of the Willimantic quarry and of several others.* The quarries in Greenwich afford several light colored varieties of gray granite, but are wrought almost exclusively as a common building stone, and are taken in large quantities to New York city.

Other localities deserving to be indicated as likely to furnish valuable deposits of this stone, are the following: Stonington, Groton, the country between Norwalk and Darien, North Fairfield, north part of Wilton, region in vicinity of Torringford and Wolcottville, Winsted, western part of New Milford, Canada village (Goshen,) Warren, Marlborough, and Voluntown.

There is but one quarry of the white granite which is wrought at present. It is in Plymouth, near the woolen factory of Mr. Henry Terry. The bed is extensive, forming apparently the western side of a hill, which is above a mile long, though concealed to a considerable extent by soil. It is the most beautiful granite in the State (51*b*); nor is it surpassed in whiteness and transparency of material by any granite in the country. The distance from water-communication only prevents it from being a source of great value to the proprietors. It is deserving of consideration, whether it would not bear transportation to the Farmington canal. White granite exists also in the western border of Voluntown (34), one mile southwest of Norwalk (29), in Chaplin (26), in Canaan, and in the western part of New Milford.

The flesh colored granite (of a dull grayish tint) is particularly abundant in the towns of East Haven, Branford, and Guilford; and if judiciously explored might lead to the discovery of quarries, whose value would be enhanced from their contiguity to the Sound.

A quarry of reddish white, quartzy granite is situated within eighty rods of the Thames in North Groton (69*b*), three miles below Poquetonnock. It is owned by Capt. Stoddard. The ingredients of the rock are so arranged as to impart to it when dressed, a veined appearance. Its texture is less compact than is desirable for a gran-

* An account of the Haddam and Connecticut river quarries is reserved for the head of *Flagging*, since this is the almost exclusive use to which they are applied.

ite to be employed in decoration: the feldspar is too minutely divided, considering it bears so small a ratio to the quartz. The rock, however, is free from iron-pyrites; and when dressed, produces an agreeable effect. It is much used in Norwich, and has been sought after to some extent in New York city and its vicinity. The quarry employs about eight hands. The proprietor receives six cents a foot for the stone; for which sum however, he incurs the expense of transportation from the quarry to the river. The quarry has yielded thirty thousand feet in one year.

Another valuable granite of the pale reddish white variety exists at Portersville, situated about one hundred rods west of the old battery. Its color partakes slightly of the yellowish tinge, and its grain is exceedingly fine. As yet the quarry has only been opened. Appearances indicate a bed of considerable extent; and its short distance from the river must contribute to enhance its importance. A similar variety is very abundant on Candle-wood hill, distant nearly two miles in a northwesterly direction from Portersville. Small quantities have been quarried at this last place for upwards of twenty years. Granite of a similar quality, but considerably different in appearance owing to the presence of thin, slender black prisms of mica (44*b*), occurs on land of Mr. SAMUEL LANGWORTHY at Upper Mystic, where a quarry has recently been opened. It splits into long slender posts with great facility. Eighteen hundred feet were quarried last season for Mr. CHARLES PHELPS of Stonington, at an expense of ten cents the foot. The bed is situated at a distance of eighty rods from water-communication.

A red granite of a still deeper color, is found a little north of the village of Upper Mystic (45). It has already been used as an underpinning stone in the vicinity of its locality. It works freely, and when dressed is a very handsome stone. Limited beds of flesh colored granite occur upon the railway also, near Stonington point (46*b*, 47*b*). A variety at North Stamford (24), is a rock not unsuited to ornamental architecture, and even to many purposes of decoration, as its whole tone of color and effect is often very beautiful, and entitle it to be compared with specimens of Egyptian granite. Red feldspar is the leading ingredient, through which are disseminated albite-grains and a semi-transparent quartz. Light greenish mica is also rather abundant in the compound, with minute grains of

the same mineral of a black color. This rock is found in place near the meeting-house, and is apparently very abundant.

The epidotic granite is very common in Chatham, west of the cobalt-mine, and at Eastbury. It is wrought to some extent throughout this region, and more particularly near Eastbury. From the abundance of mica it contains, it is more brittle than the gray granite. It is therefore quarried more freely, but probably demands greater care in dressing, as it cannot so well sustain the shock of the hammer. It is on the whole one of the most beautiful varieties of our granite, and will come into extensive use when better known.

Green porphyritic granite is found to some extent throughout the region of the epidotic granite, and may be seen in considerable variety at Roaring-brook in Glastenbury. Still more beautiful varieties were observed near the line of Brooklyn and Killingly. It is a fine rock unless it contain an excess of mica, which is rarely the case. Some of its varieties, especially that with flesh-red feldspar (54) from Killingly, would constitute when polished a strikingly beautiful rock.

Gray porphyritic granite is one of the most abundant rocks in the State. The coarse varieties (55), particularly those found in Derby, Bridgeport and vicinity, are sometimes rudely dressed for common uses, and present a singular mosaic effect when laid up in fences and in the walls of factories. The finer varieties, in which the feldspar is in smaller individuals, is scarcely distinguishable when dressed, from the gray granite. It is quarried a little northeast of Humphreysville, also in Thompson near New Boston (50). At the last place, it occurs in beds with cross-seams from one to four feet apart. Other localities are Hearth-stone hill (partly in Norwich and partly in Franklin) and between Abington and the Factory-village in Ashford.

The black chloritic granite so strongly resembles sienite (into which rock it probably passes), that when dressed, the two would not ordinarily be distinguished. The labor of working it however, would be considerably less; for though it is extremely tough, yet the absence of quartz and hornblende would greatly add to the freedom of its preparation. It would probably rank very high, on account of its qualities for strength and inalterability. As it is very common in the fences of Lebanon, and enters largely into the formation of a considerable elevation north of the village, it is no doubt a very common rock in that region.

Green chloritic granite must possess many of the advantages of the variety last noticed, its ingredients being essentially the same; but the effect of its color would be quite different and entirely unique for a rock of this class. It is difficult to say which shade of color preponderates, the purplish gray or the leek green, or what would be the general effect of the rock when dressed. I observed it only in the southeastern part of the State. It was abundant in detached masses in the diluvium of Stonington, and occurred in place north of Lantern-hill in North Stonington.

The pseudo-sienitic granite (71*b*) exists in Chatham, two and a half miles north of Middle Haddam landing, at a place called Great-hill (or Stewart's hill), which adjoins the cobalt-mine hill. It has been quarried for several years, and is decidedly the most valuable repository of granite in the State, taking into consideration its contiguity to water-communication. It is a very handsome stone, and quarries with great facility; so much so, that it is split out in large quantities as curb-stone. It is dressed with greater freedom than the fine-grained granite in the eastern part of the State, and in this respect resembles the granite of Maine. As the supply is unlimited and the nature of the ground favorable, an inclined plane will no doubt one day be constructed from the quarry to the river, which is distant but one and a half miles. The number of hands employed at present is but six, though the quarry has furnished employment some seasons, to upwards of thirty men. It supplied a large quantity of stone in 1832, to the contractors for the Delaware and Hudson canal, and has aided in the construction of the fortifications at the mouth of the Chesapeake. At present, it is chiefly wrought for the supply of the New York market.

Every variety of sienitic granite may probably be obtained in the western part of Litchfield. The want of internal communication in that part of the state however, must for the present preclude its exploration.

The limestone and dolomite (marble) of this State have heretofore attracted little or no attention in architecture, notwithstanding white marble is a building material the most consecrated by time and approved by the general taste of mankind.

Of dolomite we possess inexhaustible quarries, some of which are capable of furnishing a marble equal in beauty and strength to many

of the marbles of antiquity. The towns of Washington, New Milford, Brookfield, Danbury and Ridgefield, also those of Kent, Sharon, Salisbury and Canaan, particularly invite research with this view. Most of the quarries and lime-kilns where this rock has been explored, exhibit it with the defect of foreign minerals (446, 463), with too large a grain (350), or possessed of too feeble coherence (221). The marble-quarries at New Preston (Washington) however, as well as several of the lime-quarries, often yield blocks adapted to architecture.

It is only at New Preston however, that this dolomite is employed as marble. The quarries are five or six in number, and almost immediately contiguous to each other, within a space of one mile. Unfortunately for the economy of working them, the beds are in the valley of the little Aspetuck, and at a low level; consequently, the draining of them is often attended with difficulty. The contiguity of the stream, though an evil in this respect, proves nevertheless of essential importance for carrying the mills by which the marble is slit into slabs. The number of mills for this purpose, within a few miles of each other on this stream, is sixteen; but all of them are not in operation at present. The average yield *per annum* of the quarries, in rough blocks, is between seven and eight thousand dollars; and nearly the same amount is derived to the mills and marble-shops of the immediate vicinity, for preparing the marble for use.

The quarries of Sing Sing, Westfarms and Kingsbridge, belong to the same formation as our dolomite-range, and fully justify from their long and successful exploration the opinion, that our region is yet destined to afford much larger supplies of marble. The economy with which this stone is wrought, and especially the polish it receives and retains, recommend it to a more extended use.

But the most valuable material in ornamental architecture found in the State is the sandstone. It is a stone presenting numerous shades of color, from nearly white (246), to brick red (247) and dull brown (245). Its texture is in general fine, the rock being composed of little rounded or angular fragments of quartz and feldspar, held together by an argillaceous or an argillo-ferruginous cement. And notwithstanding the coherence of this rock is often very feeble when taken from the quarry, it hardens to such a degree on expo-

sure to the air, that it has been found suited to the purposes of delicate architectural ornaments and even to statuary. Its value is enhanced by the fact, that it occurs in nearly horizontal beds, which only require to be wedged in a perpendicular direction, to cause them to separate into blocks and columns of any desired dimensions. Its softness is such, that it can be easily wrought; while its specific gravity is considerably lower than that of granite and limestone. These advantages will always render it the most economical building material we possess. The only objection that can be urged against its use in ornamental architecture is, that it is less enduring than granite and limestone; and yet the sandstone of some quarries nearly rivals the granite in withstanding the effects of the weather.* The heavy brown hue of a large proportion of this stone, has had some effect to diminish its employment in the more tasteful private buildings, the opinion prevailing that it is rather suited to massive edifices in which the Gothic style is copied. This has confined its use to churches and large buildings, excepting its employment for stepping and underpinning stones, door-posts, window-sills and caps. It is especially preferred for the last mentioned purposes in buildings constructed of brick, as its color harmonizes so perfectly with this material.

It is unnecessary to enter into details respecting the sandstone quarries of the Connecticut valley. There is scarcely a neighborhood not affording this valuable material in sufficient quantity for its own demand; while the great quarry at Chatham which employs two hundred men, furnishes blocks to all the maritime cities in the United States. Its very great facilities for supplying, added to its contiguity to the river, give it an advantage in shipping this stone, which it is doubtful whether any other quarry in the country will ever be found to possess. As a very peculiar variety on account of its color, the quarry at Wapping (East Windsor), is entitled to mention. The sandstone here is of a bright and uniform brick-red (247).

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* In opening quarries of this stone, the utmost attention should be devoted to the qualities of the stone, with respect to its liability to decomposition. It is often a difficult question to decide from masses freshly quarried, or from their comparison with the stone of quarries, already ascertained to be good. Important light can often be derived from an inspection of loose masses of the same stone found in the vicinity: if they are indurated and firm, no hesitation need be felt respecting the qualities of the quarry.

The most interesting deposit of sandstone for ornamental architecture yet developed in the State, is situated in North Haven, at the east end of Mount Carmel, on the middle road between New Haven and Hartford. It has but very recently attracted attention. Whether it exists in beds of sufficient extent to justify being wrought, remains to be ascertained. Its color is lighter than most granites. A light flesh colored feldspar is the chief ingredient in its composition. The quartz present is semi-transparent, and possessed of its ordinary vitreous lustre. It contains a decomposed mineral, having a pistachio-green color, distributed through it in little cavities, which modifies the color of the rock when fresh, but would probably disappear on a short exposure to the weather. The texture of the rock is so firm, and so fresh is the lustre of its ingredients, that it would ordinarily pass for a granite.

North Branford affords several very interesting varieties of sandstone, which will merit investigation. They are situated along the western base of the Toket range. At one place where it has been slightly explored, it closely resembles granite in color (240); and at another, it is very fine grained and of a light red or chocolate-brown color (249). The quarry of Capt. Rose in this town, on the eastern side of the same range, is well known for some distance in the vicinity, as affording a stone quite analogous to that of Chatham.

The sandstone of the copper-region in Granby (244) is a peculiar, light colored variety. It is already quarried to some extent, and merits from its contiguity to the Farmington canal, a more thorough examination. A quarry belonging to Mr. Cowles, two and a half miles from Farmington, is valuable for the same reason. Its quality is favorably exhibited in several buildings in the village of Farmington.

Upon the common building materials of the State it may be remarked, that we have but few rocks unfit for cheap and ordinary structures. If we except mica-slate, argillite, talcose and chlorite-slate, the more fissile shales and marly slate of the secondary, all the others are more or less employed. Trap is most used in the valley of the Connecticut, and is not surpassed for strength and inalterability by any other stone. It is frequently quarried without the aid of gunpowder, the seams of the rock being taken advantage of, in

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detaching it from its beds. The natural faces of the stone are so smooth, as to require little or no labor in preparing it for use. Next to trap, coarse sandstone-conglomerates are used in the same region. Many of these are so soft as scarcely to cohere when raised from their beds, but after a short exposure to the air they become firm; and when laid up in mortar, form a most durable building-material, and one well adapted to receiving the stucco-finish.

Common building-stone is quarried at several places in the State, for exportation. It is generally spoken of as foundation-stone, or as fort or block-stone. Large quantities are shipped from the quarries situated immediately on the banks of the Connecticut and the Thames, to be employed in New York and in the public works along the coast. The quarries on the east side of the river at Haddam are particularly engaged in this business, and employ forty or fifty men. Lord's quarry in Lyme is well located for affording this kind of stone. In 1832 and 1833 it employed upwards of thirty hands, being then engaged in furnishing stone for the construction of canal-locks in New Jersey. The stone for the foundation-work of the Merchants' Exchange in New York was supplied during the last season from this quarry.

Chapman's quarry of granitic-gneiss on the east side of the Thames in Groton, a few miles above New London, is also extensively engaged in furnishing block-stone. Twelve hands were employed here last summer. The stone is quarried at an expense of twelve cents the foot, and its freight to New York costs from six to eight cents. A quarry for similar stone on the opposite side of the river in Waterford, was worked five years ago to furnish stone for the public works at Pensacola. Common building stone is extensively quarried also at Greenwich, both for the construction of public works and for ordinary building in the city of New York.

It will not be necessary to mention many of the quarries of common building-material for home-consumption. The city of Hartford is chiefly supplied from the trap of Rocky Hill, while New Haven in addition to an extensive use of the same material from East and West Rock, derives a large amount of building-stone from the sandstone-conglomerate of East Haven. The quarries of the last mentioned rock gave employment to fifty hands during the last summer. A coarse conglomerate (243*b*) is quarried at the west end of Mt. Car-

mel in Hamden. It is worked to much advantage, and being within eighty rods of the canal must be a source of great accommodation to the vicinity. The thick micaceous quartz-rock in Killingly is one of the most convenient building stones for common purposes in the State, and is much employed in the construction of factories. A peculiar granitic gneiss (86*b*) at Union village, Plainfield, in consequence of natural cleavages, is advantageously used for the same purpose.

Materials for Decoration.—By these is meant such rocks and minerals as are employed for monuments, fountains, statues, mantel-pieces, table-tops, and the subordinate parts of the most splendid edifices, as door-steps, posts, sills, &c.

The white marble of Washington has long been in high repute for many of the purposes of decoration. It is of an unstained white color, and when in masses sufficiently free from tremolite and not too tender in its texture, is admirably adapted to monuments, for which purpose it is mostly employed. The quarries from whence it is obtained have already been mentioned, and form a range along a narrow valley of one or two miles in extent, the limestone being only a few rods wide, and scarcely protruding above the surface of the ground.

Connecticut possesses however, in the green marbles of Milford, a material of decoration much more beautiful and highly prized than white marble. These were first detected in 1811 by Mr. Solomon Baldwin, a student of Yale College; and were brought into notice by Prof. Silliman. Two quarries were soon after opened, one near the village of Milford and called the Milford quarry, the other two miles and a half west of New Haven, and called the New Haven quarry. They were wrought with considerable activity for several years, and furnished an abundance of very rich marble: but as the working of them was attended with heavy expenses, from the difficulty of obtaining blocks of large dimensions that were perfectly sound, and from the labor required in sawing and polishing, they were in a few years abandoned; and have for a long time been in a neglected condition. The experiment proved an unfortunate one therefore, not from any deficiency of marble or its lack of beauty, for these were both fully admitted; but from a want of wealth and taste in the country to sustain the enterprise. It was perhaps an unfortunate circumstance that the whole of the marble afforded by these quarries was denominated the *verd antique*, whereas but a

small part of that furnished only by the Milford quarry, is strictly entitled to this name. Had this distinction been attended to, and such slabs and blocks as possessed this character been carefully selected, it is possible that a demand for it might have been found in Europe sufficient to have sustained the undertaking.*

The quarry at Milford is capable of furnishing abundant supplies of this highly valued marble (230); although from the circumstance that it occupies narrow and irregular seams among the veined marble, blocks and slabs of any size must always be dear compared with pieces sawn as formerly without regard to its separation from the more common kind. And yet as we continue to derive our ideas of what is elegant in decoration from Europe, and come to possess more and more the means of gratifying a taste for luxury, it cannot be doubted that this marble is destined eventually, to come into high estimation and demand. Whenever the attempt to re-work it is made, it is to be hoped that the experience of the past will prevent its use for monuments exposed to the weather; for besides the incongruity of its color with the marbles usually employed for this purpose, it soon loses its lustre and even its color, from the action of the weather on the grains of magnetic iron-ore it contains.

The New Haven marble, though destitute of the accidental, and in some measure classical value which pertains to the Milford variety, is nevertheless a beautiful material for decoration. In vivacity of colors and the delicacy of their arrangement, it is hardly capable of being surpassed. It may be described as a bluish gray or dove-colored limestone clouded with greenish yellow serpentine, the latter containing black grains and short veins of magnetic iron-ore. The disposition of the colors is cloud-like, flamed and veined. It polishes with

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* The genuine *verd antique* is an aggregate of white limestone, green talc and blackish green serpentine, the last ingredient being so arranged through the two first, in angular, ovoidal, cubical and vein-like masses, as to impart to the rock a brecciated appearance. Wherever in a block, these pebble-like masses are wanting the verd antique ceases; although a very handsome, green, veined marble may remain. This precious marble was originally obtained as it is supposed, in the neighborhood of Thessalonica in Macedonia; or as some maintain, from Lacedemonium in the Morea. At present, however, it is only met with, in small fragments and scattered blocks among the ruins of Roman and Etruscan cities; and so scarce has it become, that its price in Paris is thirty dollars the cubic foot. Its use is therefore extremely limited, and confined only to the more costly articles of furniture.

difficulty in consequence of the iron-ore it contains, which though it heightens its beauty, unfits it for exposure to the weather.

Several of the granitic rocks in the State will one day attract attention for decoration; for although the slitting and polishing of them is attended with great expense, yet when polished they are not liable to be scratched or marred by use like the marbles and softer stones. The green porphyritic (51, 54), the green chloritic (127), and the red (24), granites are the most likely to become important in this view. The altered chloritic slate (210, 211), may prove valuable for the same purpose.

XV. Materials for Flagging, Tiling and Paving.

The flagging-stone is distinguished from ornamental and common building-stone, by such an arrangement of its ingredients as to allow it to split freely but in a single direction. This quality is usually imparted by mica, though sometimes talc or hornblende contribute to the effect. Such stone, if dressed in blocks so as to show surfaces in more than one direction, will necessarily exhibit a want of correspondence in color on the different sides; besides its strength is not uniform in each direction,—circumstances which operate unfavorably to its use as building-stone, while they enhance its value for flagging and tiling.

The flagging-stone of the State is referable to the following rocks,—gneiss, micaceous quartz-rock, mica-slate, and sandstone slate; and together constitute a resource fully equal to its building-materials. The quarries of gneiss on the Connecticut river rank very high in importance, not only on account of the intrinsic excellence they possess, but from their proximity to the river. They are situated at Middletown, Chatham, at Haddam on both sides of the river, and also at Chester, Hadlyme and Essex; and they are remarkable for the uniformity of their character in every place where they are explored in these towns, as well as further southwest in Madison, where extensive quarries also exist. It is difficult to ascertain the number of hands employed in quarrying this rock; but from such facts as could be collected, it is believed that they ordinarily fall but little below five hundred. The properties of the gneiss are in a measure peculiar: at least, no rock precisely resembles it in any part of the State. Its leading peculiarities depend upon its black mica

and transparent grains of albite. These are arranged in thin, strait, and parallel layers, giving to surfaces produced by cross-fracture a banded appearance of black and gray; while the surfaces resulting from cleavage are almost black. Both the mica and the albite possess high degrees of lustre, which impart to the rock a very brilliant effect,—rendering fresh slabs of it almost insupportable to the eyes, in a strong light of the sun. The cleavages do not take place with the greatest freedom, and can rarely be effected, so as to divide the rock into slabs of less than six inches in thickness. They are particularly prone to occur where the mica is most abundant, and this in general is contiguous to those layers of albite which are made up of larger individuals than the average size. The rock contains very little quartz. Hornblende is occasionally present, which is of a black color, highly crystalline, and brilliant in its lustre. The process of quarrying appears to be conducted with the greater facility, from the highly inclined position of the strata. Slabs of any dimensions are easily procured. Its great use seems to be for flag and curb-stones, though it is also employed extensively in the construction of wharves, bridges, breakwaters and fortifications, for which purposes its strength and inalterability render it very desirable. It is likewise used for underpinning stones, and for posts to gateways and fences which in some instances are covered by wood. As it is a material of great importance in paving, it is sought for in all the large cities, being extensively used in Boston, New York and Philadelphia, and of late has been introduced into Charleston and New Orleans, where it is likely to prove highly important in the paving improvements recently commenced in these cities. It may well be doubted whether any material will be brought to light in the country, better adapted either in quality or local situation than the gneiss of the Connecticut river, for satisfying these demands.

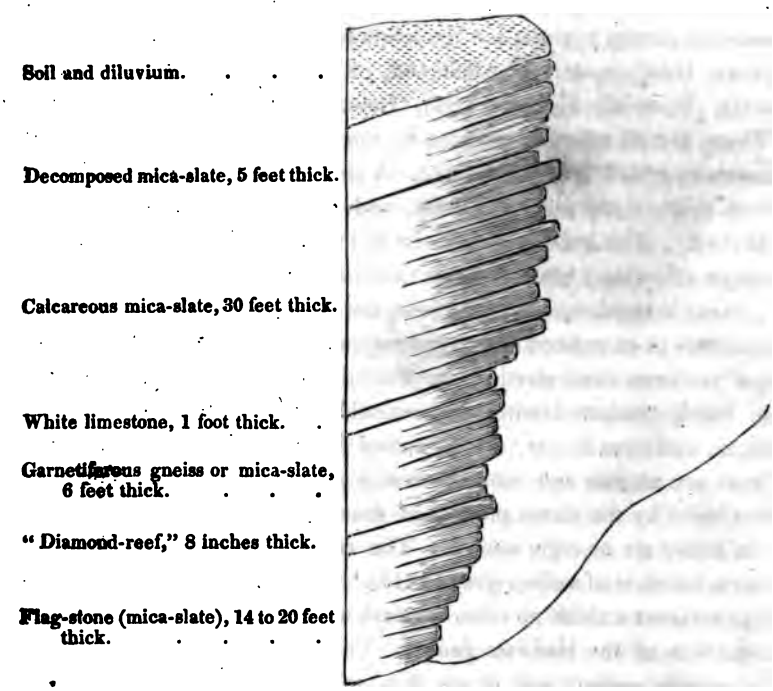
In the northwestern part of Lebanon, a little east of what is called Hearth-stone hill, a very valuable flagging is quarried. It consists of a feldspathic gneiss (89*b*, 90*b*, 91*b*). It is very thinly stratified, strait and easily separable. Much of it consists almost wholly of feldspar. Flags are quarried here of great size and any desired degree of thinness; and although the transportation by land to market (to Norwich) is above fifteen miles, they are yet afforded so low as to compete with the Bolton stone. The price varies

according to the thickness and dimensions of the slabs, from six to twelve cents a foot, in Norwich. The expense of their transportation thither is three dollars and a half a load, of from one hundred and seventy, to two hundred feet. The quarries cover several acres; but unfortunately are situated at rather low levels, insomuch that in the course of ten or fifteen years, they will experience considerable embarrassment from the access of water.

The quarries of gneissoid flagging-stone in the western part of the State, are in a more fissile and easily cleavable rock. A few of the most important of them are the following: at Thatchersville (Bridgeport), Burr's quarry Fairfield (82, 83), Judson's quarry Newtown (84), Mine-hill Roxbury (89), Banks' quarry Reading (85, 86). These are all valuable quarries for the convenience of the neighborhoods in which they are located. A thin micaceous gneiss occurs on both sides of the river at Derby, and also at Washington bridge in Milford. The hornblendic gneiss at the New Milford Falls is capable of affording a good flagging material (119).

Next in importance to the gneiss, the mica-slate of Bolton mountain deserves to be noticed as a flagging-stone. No material of this species has yet been discovered in the United States or elsewhere, capable of being compared with this invaluable stone. Slabs five feet by eight, and even larger, are furnished by these quarries, whose surfaces are as true and smooth, as any granite or sandstone could be rendered by the nicest process of dressing, and yet with a thickness not above six or eight inches. The rock derives its color from the mica, which is of a silver-gray (141*b*). It is so abundant that its cleavage surfaces exhibit no other mineral, and its lustre is no less brilliant than that of the Haddam gneiss. The stratification of the rock is extremely uniform and always thin, sometimes apparently consisting of upwards of an hundred thicknesses of mica in one inch. The layers interposed between the mica in one variety of the rock, consist of an aggregate of grains of quartz, feldspar and garnet; but each so small as to require a microscope for detection. The use for which this stone is especially fitted is for side-walks, market-houses, cellars, and foot-paths generally about houses, as well as for water-gutters. Its strength is inadequate to the support of carriage-wheels. It should therefore, in the paving of streets, be employed along with the Connecticut river gneiss, whose firmness admirably fits it for foot-paths

across streets and for curb-stones. The quarries extend for two miles along the Bolton mountain. The stratum which affords the flagging-stone is from fifteen to twenty feet in thickness; and of this the upper part, to the depth of six feet is of inferior value, affording only a small proportion of flagging-stone (147). Above this stratum is an overlie of nearly forty feet, of dark, gray micaceous limestone (146*y*) or calcareous mica-slate. The annexed diagram will illustrate the singular position of this valuable flagging-stone.



The strata dip westerly from 25 to 30°. The thin stratum between the garnetiferous mica-slate and flagging-variety is called the diamond-reef by the workmen, on account of the rhomboidal fragments into which it separates. It will be obvious from an inspection of the above sketch, that the labor of quarrying the flagging-stone must be very considerable. The superincumbent strata require to be removed as fast as the workmen advance in the removal of the flagging-stone. Thus, they are obliged to reject more than two-thirds of the stone in working the quarry; besides which they have to con-

tend against the inconvenience of water. This they are able, during the dry season of the year to withdraw, by means of lead-syphon tubes of the largest size. The same relative arrangement in the strata is found at every opening made for this stone on the Bolton mountain. It is probable therefore, that the strata are continuous for a distance of at least two miles in extent. But two quarries however, are worked with much activity at present on the mountain; one half a mile north of the notch, and the other just within the edge of Vernon. Other quarries have been opened at the notch, but they are not wrought at present. The distance from Hartford to the notch is twelve miles, and the expense of transportation is from four to five cents the foot. They are nevertheless afforded in Hartford at the low price, of from ten to twelve cents the foot. Nothing seems to be wanting to impart to these quarries their highest value, but the construction of the proposed rail-way to the Connecticut river, a work which the nature of the intermediate country would render extremely feasible. Already they afford constant employment to upwards of fifty men; and it is easy to perceive that their value would be greatly augmented if the contemplated rail-way to the Connecticut river should be constructed.

The south part of Litchfield affords a mica-slate (137) which has a thin and strait cleavage, but whether it will yield slabs of the requisite dimensions, can only be ascertained by a suitable exploration.

The quarries of Killingly have but recently been opened; and although highly promising in their character, are comparatively but little known to the public at large. The stone is altogether peculiar in its character. It is the micaceous quartz-rock, consisting almost exclusively of the species quartz. The mica present is nearly undistinguishable, and would quite escape ordinary observation but for its hair-brown color. It is most obvious on the cleavage-surfaces, where it is seen collected together into clouded patches (177, 178); but so small is its quantity on the whole, that it seems almost inadequate to account for the free and strait cleavages by which the rock separates, and yet no other cause can be adduced for their production. The mica sometimes has a yellowish tinge, in which case we have a rock so exactly identical in structure and appearance with the avanturine of Spain that samples of it are well worthy of being submitted to the wheel of the lapidary. The cleavages occur at distances, of from half an inch to

four and six inches apart, and seem perfectly parallel often for ten or fifteen feet in each direction. The surfaces of the slabs are as smooth and even, as those of the best moulded tiles. In strength, it is not inferior to any other flagging stone, if we except perhaps the hornblende-slate. It is not liable to disintegration from exposure to the weather, or from immersion in water. In these respects it surpasses in value the more micaceous slates. Judging from weather-beaten masses of the rock, it grows whiter on exposure; an effect resulting from the loss of the brown mica, which is more abundant on the cleavage surfaces than through the general mass of the stone.

The uses to which this flagging-stone may be applied are numerous, and many of them quite new. As a paving for side-walks it must be pre-eminently valuable, not only on account of the size of the slabs and their smoothness, but from the hardness of the material. The friction to which it will be subjected in this situation cannot it would seem, make the slightest impression upon it; for its hardness is superior to that of the firmest and most imperishable granite. For this reason, flag-stones from this rock which have been long in use will not require to be roughened up with the chisel, as is the case with some of the softer mica-slates. In the paving of door-yards, warehouses and cellars, its value is equally obvious. It must surpass all other materials also, for lining drains, water-sluices and canals; and it is even possible that it may prove useful in the roofing of small buildings. It is a fortunate circumstance that the supply of this stone is unlimited, and that it is favorably situated in the quarries for working. Excellent stone essentially of this kind, has been obtained at various places on one and the same range, for several miles in extent. The most important opening made at present however, is that of Bolles and Tyler. It is about three hundred and fifty feet long, fifty feet wide (of uncovered rock), and twenty-five above a narrow valley separating it from a higher ledge on the west. The direction of strata is north by east, and the dip northwesterly 40 or 45°. The rock is almost without cross-seams, which renders the quarrying somewhat difficult. Those which do occur, are from ten to thirty feet apart, and have a direction northwest by west. The rock is singularly striated in the direction of the edges of stratification. The average thickness of the layers is between two and four inches.

It should be an object of search to find some ledge in the range, in which the cross-seams are nearer together, and where the strata are more highly inclined in their position. The distance of the range from the track of the Norwich and Worcester rail-way will be about two miles. When this important route is completed, the Killingly stone will find its way to market with great facility.

Flagging-stones are supplied to a limited extent from some of the red sandstone-quarries in the valley of the Connecticut. The quarries on the banks of the Connecticut river at Enfield bridge afford good materials of this kind (255). They are constantly wrought by a number of hands. Some of the sandstone-slates at the coal-digging in Durham would answer a similar purpose. The red sandstone-slate of Rocky hill, Hartford, has afforded an inferior kind of flagging, which has been much used in that city.

Tiling.—A partial exploration was formerly made in the argillite of Woodbridge, at the mills, on the old road to Humphreysville. The quality of the rock at this place would warrant the re-opening of the quarry. Its grain is almost impalpable,—its cross fracture exhibiting only very minute, scarcely perceptible, brilliant points. It cleaves into sheets one-tenth of an inch in thickness, and which still possess considerable strength. It is capable of being pierced with a nail without cracking, and retains its hardness under water; nor does it appear to exfoliate from exposure to the weather, during the winter. From present appearances however, the quarry would not yield slates of large dimensions, though probably of a size large enough for roofing.*

Paving.—This is a subject deserving the attention of the two principal cities of the State; and though hitherto much neglected, a regard to comfort and convenience will soon lead to its consideration. Whenever it shall be thought an object, the materials best suited to the purpose will be found at hand in the prismatic trap of the country. Scarce any considerable tract of the trap-region fails to afford the variety which separates spontaneously into three, four, or five sided prisms, of a length several times that of their diameter. As a preparation for their emyloyment, the street would require to be graded as usual, and then covered with a bed of coarse gravel. The prisms selected should have a diameter of from eight inches to one

* The chlorite-slate of Milford point merits examination with the same view.

foot, and a length double that of their breadth. They should be arranged side by side in a vertical position, and in such a manner as to leave the fewest possible spaces; after which, the surface of the street should be kept covered with sand until all the crevices are filled. A pavement thus constructed would have all the smoothness of a macadamized road; and from the strength and shape of the materials, must excel for perpetuity every other mode of paving.

XVI. Mineral Springs.

Our active mineral waters fall under the head of weak chalybeates, some of which are feebly sulphureous. None of them are possessed of alkaline or acidulated properties. But though insipid to the taste, and supposed to contain little beside carbonate or sulphate of iron, the effects they exert upon the animal economy are in many instances decided, and highly important. The failure of chemists to detect active medicinal ingredients in such waters, has it is to be feared, sunk them too low in the estimation of medical men. The recent discovery by Berzelius of two organic acids, the crenic and the apocrenic, in nearly all ferruginous springs, it is to be hoped will excite public attention anew to the subject. The salts formed by these acids may prove important to medicine. A few springs had attracted attention in which chemical tests fail to detect any mineral or vegetable ingredients, and which if possessed of useful properties, must arise from the unusual purity of the water.

The most important springs in the State are those of Stafford. Ample accommodations here exist for invalids, and during the warm season they are a favorite resort. No perceptible escape of gas from the water was observed. The sides of the reservoir were lined with a thick flocculent precipitate of the oxide of iron, occasioned by the decomposition of the carbonate of iron from the access of air.

The spring at Prospect hill in the western part of Litchfield (alluded to under magnetic iron-pyrites in this report) has a very perceptible styptic taste and a slight sulphuretted odor. Tested with chloride of barium and ferro-cyanide of potassium, it clearly evinced the presence of sulphate of iron. It was first publicly noticed by Mr. James Pierce of Litchfield, in the American Journal of Science. He states that an astringent effect and soreness of throat is produced by a free use of the spring; and that it had effected cures of obstinate

rheumatic complaints that had resisted ordinary remedies. It is farther remarked that the water was weekly sent to Hartford, and had been esteemed equal to the Stafford spring. As the ore by whose decomposition the spring is impregnated contains also, minute quantities of yellow copper-pyrites, the presence of sulphate of copper in the water, was suspected; but the addition of ammonia produced no discoloration; from whence, it was inferred that if present, its quantity is too small to prove deleterious.

Other chalybeates concerning which information was acquired during the survey are at the following places: 1. Kent ore-bed; 2. Danbury (at Beaver brook); 3. Cornwall (1½ miles S. W. of meeting-house); 4. Washington (road-side, between the furnace and the marble-quarries); 5. Winchester (on land of Mr. C. Sopper); 6. New Hartford (on land of Mr. Atwood); 7. Litchfield (on land of Mr. E. Clark); 8. Roxbury (on Mine hill); 9. Suffield (on land of Mr. E. Granger); 10. Woodbury (road-side, near the house of Mr. J. R. Edwards); 11. Oxford (on land of Mr. Nathan Mansfield); 12. North Haven; 13. Colchester (on land of Mr. Samuel Gillet, also of Rev. L. Strong); 14. Chatham (on land of Mr. Abby); 15. Upper Mystic (on land of Mrs. M. Williams); 16. Brooklyn (on land of Mrs. Danielson); 17. Woodstock (on land of Mr. H. Bugbee*); 18. Manchester; 19. Lebanon; 20. Watertown; 21. Middletown; 22. Greenwich.

From the observations made connected with the above mentioned springs, it appears not improbable, that chalybeates occur in nearly every town in the State. The essential condition for the production of such waters, appears to be simply the breaking up of springs through deposits of bog-iron-ore, or between strata abounding in iron-pyrites.

Of springs which on the application of the ordinary tests appeared to be unusually pure water, may be mentioned, one in Killingly on the estate of Judge Chase, and another on the Sherman and Reading turnpike, on land of Mr. Stephen Gregory. A mineral spring

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* The Woodstock spring is represented by the proprietor to have undergone a regular analysis by Dr. Parsons of Providence (R. I.), and a manuscript copy of the following results is shown to persons who visit the springs. "The water belongs to the class called *chalybeate*. The three springs differ from each other

one mile east of Salisbury meeting-house, indicated only the presence of chloride of calcium together with a little carbonate of lime. The rocks over which this water runs are covered with a thin incrustation of calcareous tufa.

XVII. Materials for Agriculture.

It has been noticed from the earliest times that certain marked distinctions exist in soils, qualifying them in different degrees for the purposes of agriculture. Accordingly we have what are called hard and soft sandy soils, clayey soils, light and dark colored molds. Chemical analysis has shown the ground on which these diversities depend; and has made us acquainted with the exact constitution of particular varieties, found best suited to certain crops. Thus a soil which was well adapted to oats, wheat and barley, afforded in 100 parts, 11 of carbonate of lime, 9 of vegetable and animal matter, 4

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chiefly in the proportion of iron they contain. The first, or north spring, contains in one gallon,

Carbonate of soda, about	10 grs.
Carbonate of iron,	2

with a very minute portion of lime and salt.

The second, or middle spring, contains in one gallon,

Carbonate of soda,	15 grs.
Carbonate of iron,	3½

with a very minute portion of lime and salt.

The third, in one gallon,

Carbonate of soda,	16 grs.
Carbonate of lime,	8
Carbonate of iron,	4

with a minute portion of salt.

"The three springs contain carbonic acid gas, the exact amount of which can be determined only at the springs where the water is drawn. It is this gas which holds the iron in solution, so that the water is perfectly clear when first taken from the spring, but when allowed to stand for a short time in an open vessel, the gas escapes and leaves the iron on settling, which gives the water a turbid appearance, and finally collecting on the sides and bottom of the vessel, it resembles rust or oxide of iron.

"The second and third springs are best for drinking, and the first is best for bathing."

It is wholly inconceivable how the foregoing statements could have been made respecting these waters. If the results quoted were obtained by the gentleman above named, it is certain that the water submitted could never have been afforded by these springs: for the first spring differs in no respect from common water, and the other two are merely chalybeates of the usual character.

of water, and 45 of finely divided clay (more than half of which probably consisted of silica, and the rest of alumina and oxide of iron), the remaining 31 being coarse gravel. Another sample from a field yielding wheat and beans without manure, consisted of $\frac{1}{4}$ siliceous sand and $\frac{3}{4}$ calcareous clay tinged with iron, the aggregate containing 5 per cent. of vegetable matter. A good soil for wheat in France had for its mineral basis, $\frac{3}{4}$ clay, $\frac{1}{4}$ river-sand and $\frac{1}{4}$ carbonate of lime; and a soil for potatoes in Cornwall (England) had $\frac{7}{8}$ siliceous sand, with an absorbent power so small as to lose only 2 per cent. by drying, at a temperature of 400°. It is from information obtained in this way, that the rules for improving the mineral constitution of soils have been derived.

It does not fall within the province of this report to point out the different kinds of soil, and the extent of each sort in the State. They will only be alluded to in a general manner, with a view to important mineral amendments, capable of being availed of to some extent, within our territory. The soils of Connecticut, like those of most primitive regions, are especially deficient in carbonate of lime.* This was not proved to be the fact from an actual analysis of soils collected in different sections of the primitive, but is deduced from the known character of the rocks from whose decomposition they have proceeded. As respects a leading variety of soil (a sandy loam) in the valley of Connecticut, careful analysis confirms the character ascribed above to the soils of the State. The sample was taken from a field sparsely covered with cedars, pines and oaks, situated in Hamden, and about sixty rods north of what is called High rock. It yielded, on a specimen thoroughly dried by several days exposure to the sun, the following results:

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* Local tracts of small extent in the limestone-section of the State, and in the immediate vicinity of calcareous amygdaloids and marl-slates, are exceptions to this remark; so also are those patches of land of still more moderate extent, situated directly upon the Sound, in which sea-shells are more or less thickly disseminated. In these situations, the natural fertility of the soil is most apparent; and its adaptedness to wheat and rye is particularly striking.

In one hundred parts,	
Water of absorption,	3·05
Vegetable matter,	2·94
Alumina,	7·19
Peroxide of iron,	2·83
Oxide of manganese,	0·17
Lime,	0·06
Magnesia,	0·04
Silica, (53·42 in condition of small quartz-pebbles,)	83·80
	100·08

As the State is not furnished with the recent calcareous marl-formations, the only mode of making up this signal deficiency in the mineral constitution of her soil, obviously consists in a resort to the practice of liming. Nor will the remedy throughout a large part of the State be attended with very considerable expense, even compared with that of the marling system. The average dose to the acre as a preparation for a grain-crop, will rarely exceed thirty or forty bushels;* and when lime is burnt with the requisite economy, the cost of this amendment will no longer be an obstacle to its use. The saving of labor in applying so small a quantity of material, compared with the bulky article of marl, must be obvious.

It will be of the utmost importance however, to avoid the use of the dolomitic, or magnesian lime, for the purpose here recommended; as it has been fully demonstrated in Europe, that quicklime of this description instead of improving the qualities of a soil, exerts a positively injurious effect on vegetation, at least for a number of years after its application. This consequence of the use of dolomite appears only to follow, when it has been burnt; for the disintegrated, or pulverized rock, if spread upon land proves beneficial. Farmers in the vicinity of the lime-kilns in Litchfield county, have made partial trials of the use of lime on lands; and in all cases where it was employed free from admixture with wood-ashes, the testimony was unfavorable to its utility as a manure; a result to have been expected, inasmuch as the lime-kilns of that region are exclusively fed with a dolomitic limestone. The distinctions between pure limestone

* That for ordinary marl is above one thousand.

and dolomite, and the kinds of lime to which they give rise on burning, have already been pointed out, in the section on quick-lime and water-cement. The repositories of the two rocks were also mentioned under the same head; farther allusion to them will not therefore be required in this place.

No subject connected with the agricultural interest of the State more loudly demands immediate attention, than that of liming. Should the system be intelligently engaged in, it is believed that her crops would in a very short period be doubled; and at an expense that would well justify the practice. For "soils," it has justly been remarked by M. Puvis,* "not calcareous, whatever may be the culture, and whatever may be the quantity of manure lavished on them, are not suitable for all products, are often cold and moist, and are covered with weeds. Calcareous manures, by giving the lime that is wanting on such soils, complete their advantages, render the tillage more easy, destroy the weeds, and fit the soil for all products."†

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* On the use of lime as a manure, by M. Puvis, translated for the Farmer's Register. Shellbanks, Va. 1835.

† The employment of lime is rapidly extending in Pennsylvania and New Jersey; and has already very nearly led in some counties, to the disuse of plaster altogether. The limestone made use of in Bucks, Lehigh and Berks counties, and probably elsewhere, is free from magnesia. Samples have been examined from several localities which furnish the kilns from whence the supply to the farmers is derived, in none of which has magnesia been detected. One specimen from Allentown was submitted to analysis under the impression, that it abounded in silica,—the rock having a fine-grained arenaceous texture; but it was found to contain but 1·6 p. c. of silica, and was entirely free from magnesia, alumina, and even oxide of iron. The Thomastown (Me.) limestone which is burnt at Newark (N. J.) by Mr. Tompkins, for agricultural purposes, is also free from magnesia. Individuals in the vicinity of Allentown, employ from six hundred to three thousand bushels of lime per year, according to the dimensions of their estates. It is carted from twenty to thirty miles, in some instances, from the kilns. The quantity per acre varies from thirty to one hundred bushels, according to the strength of the soil,—the largest quantity being used where the land is richest in vegetable and animal matter. The dressing is administered once, in from five to twelve years. Where the soil is thin, it is necessary to plough in the lime, the deepest. It is always added in the slacked state, and generally in the fall of the year. After liming, a crop of buckwheat, oats, or corn is taken off, previous to one of wheat.

The following remarks are abstracted from a review of Essays on Calcareous Manures, in the American Journal of Science and Arts, Vol. xxx, p. 161. "In the north of England and in Scotland, the use of lime as a manure, may almost appear

It will be interesting information to all persons who feel any concern in the agricultural prosperity of the State to learn, that an enterprising individual, Mr. Levi S. Platt of Danbury, is about to commence the burning of lime for the supply of farmers in that section. The deposit from whence his kiln is to be furnished, has been selected with great care; and the undertaking, if encouraged as it deserves to be, will introduce a new era in the agriculture of the State.

Beds of clayey marl, useful for agriculture, have confidently been supposed to exist in the Connecticut valley. Calcareous deposits in this region however, are not more strongly developed than in the contiguous primitive. In a few instances, there occur thin beds of a fissile dark brown slate, (281, 283, 284, 285, 286) which emits an argillaceous odor on being moistened, softens in water, effervesces with acid, and spontaneously falls to powder on exposure for a year or two to the weather. It is therefore fully entitled to be denominated a marl, and would unquestionably prove serviceable as a dress-

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to be excessive. Two hundred bushels per acre are often applied to sandy soils, and from three to four hundred on clay. Dressings of this amount are renewed once in every term of twenty-one years. This high rate of application could not however, be practiced upon land not yet habituated to its use, and would in most parts of the United States, be too costly to yield any profit. In England, the lime is usually laid in small heaps on the fields in its caustic state, and spread as soon as it becomes air-slacked. In the department of L'Ain in France, the dressings are about eighty bushels to the acre, and are applied as a preparation for every grain crop. The lime here, is also laid on in heaps, in its caustic state; but these are immediately covered with earth, which remains until the lime is slacked, when the earth and it are intimately mixed, and after having rested for a fortnight, are again thoroughly incorporated. In this state they remain for another fortnight, when the whole is uniformly distributed over the ground. In Flanders, the quantity of lime applied is from forty to fifty bushels to the acre, and the dressing is not repeated oftener than once in ten or twelve years. The lime is usually mixed with the ashes of bituminous coal or of turf, or formed into a compost with other manures. In the department of La Sarthe, the lime is applied at the rate of twelve bushels to the acre, once in three years, and in the form of compost. In the opinion of M. Puvis, this method, although the least expensive, is the best; and it may be said to be within the reach of almost every American agriculturalist. The advantage of the use of lime may be stated in a few words: it is an essential part of the seed of wheat, and that valuable grain will not grow in any soil which does not contain it. It may therefore be reasonably hoped, that the culture of this plant may, by the aid of lime in this comparatively cheap mode, be restored in those districts whence it has long been banished."

ing for light sandy lands. The deposits alluded to, occur at South Britain, at the water-limestone quarries in Southington, and at Sawmill hollow in Durham. Adequate research would probably bring to light other, and perhaps more important, localities of this material.

A more abundant and widely diffused formation in the Connecticut valley, which is capable of use as an amendment, is the red and brown shale-clay. It often constitutes by itself large beds, or occurs interstratified with the red sandstone-conglomerate. It is extremely prone to crumble into a red pasty soil wherever it is exposed to the weather; and in the spring of the year may be removed from its beds with great facility, simply by means of shovels and spades. Where favorably situated in the vicinity of light sandy soils, it might be spread over them with undoubted benefit.

The prevailing scarcity of fresh water-mollusca in the State, renders highly problematical the discovery of extensive beds of the calcareous, lacustrine formation. These, wherever they exist in quantity, constitute eminently useful applications to land. The only indications of such deposits hitherto observed in Connecticut, occur in the parish of New Britain in Berlin. In excavating a raceway for a manufactory here, a bed of this character was struck, which abounds in bleached shells belonging the genera Planorbus, Lymnæa and Cyclas, and which afforded the rare fossil curiosity of a vertebral bone belonging to the mastodon.

SCIENTIFIC REPORT.

THE order adopted in the present section is the Natural History classification, which is the same arrangement as that observed in the disposition of the samples, intended for the illustration of the simple minerals of the State.*

CLASS I.

ORDER IV. SALT.†

Genus 7. *Vitriol-Salt.*

White Copperas is found at several of the principal localities of iron-pyrites and of magnetic iron-pyrites. Wherever either of these minerals, or the mixture of the two, are exposed to the joint influence of air and moisture, a mealy efflorescence of the present species makes its appearance. Certain conditions with which we are not fully acquainted promote or retard its production. Thus it forms with unusual rapidity in the aggregate of magnetic-iron, hornblende and iron-pyrites, on Brown's mountain in Washington (333 *b*), likewise at the copperas mine in New Fairfield and the brimstone ledge in North Madison (575 *b*); whereas the iron-pyrites ores of Litchfield and of the topaz-vein in Trumbull are very slow in giving origin to this salt.

Genus 10. *Alum-Salt.*

Alum occurs only in very limited quantity at a few localities, and always as an efflorescence on pyritiferous mica-slate. The most

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* The idea of treating the subject according to the different geological formations, and the varieties of rocks, or natural repositories in which the minerals occur, first presented itself; and many observations were made during the survey with that special view; the plan however, was abandoned, out of regard to the repetition and prolixity to which it would lead, and for the reason that the most interesting facts connected with such a view, will naturally be included in the geological report of Dr. PERCIVAL.

† Several species in the three first orders of this class, and which are either gaseous, fluid, or found in a state of solution, might have been enumerated among the minerals of the State; but their occurrence and nature are in general so well understood, as not to require a distinct mention.

remarkable locality is in the town of Plymouth on the east side of the Naugatuck river, three quarters of a mile north of the Waterbury line. It here occurs on the protected side of a high shelving ledge, forming crusts in many places one-eighth of an inch thick. These however, do not adhere for any length of time to the rock; but scale off with the quartz and mica and descend to the bottom of the ledge, where a considerable accumulation of sandy debris, impregnated with the salt is formed. The crusts in some instances, are visibly composed of short silky fibres of a pure white color. Its taste is sweet and astringent. Its composition for the greatest part is not that of the alum of commerce, but in place of an alkali, contains protoxide of iron, in the proportion of from 12 to 15 per cent., though it is very probable that the common potash-alum is occasionally intermingled with this salt.

CLASS II.

Order I. Haloide.

Genus 3. *Malachite-Haloide.*

Chrysocolla.—This beautiful mineral, in small quantity, attends the vitreous copper and variegated copper of Wolcottville.

Cube-Ore as a secondary product, derived from the decomposition of mispickel, has been observed in drusy coatings on this ore at the arsenic-mine in Derby. Its color is grass-green with a shade of gray.

Nickel-Green.—This rare mineral has only been detected in the most minute quantity, associated with copper-nickel in the cobalt-mine of Chatham. It is pulverulent, and of a grayish-white, apple-green color.

Genus 4. *Fluor-Haloide.*

Fluor.—The State appears to contain but a single important deposit of this species, which is in Trumbull near the line of Monroe. It here occurs forming the bulk of a vein about eighteen inches in width, cutting across a white gneissoid-limestone, and in a second spot under somewhat similar circumstances, at a short distance in a southwesterly direction. The first mentioned vein has been laid open to a depth of ten feet, and for several rods in extent. The fluor is the leading constituent of the vein, and is associated with

topaz, mica and quartz, and in certain parts of the vein with several species of pyrites (572). The fluor is rarely crystallized. A few examples of druses of small rich purple, and in variegated cubes with beveled edges (334) have been noticed; but nearly the whole vein exhibits a large granular composition and a light purplish-red color (338), which on exposure to light soon fades out to grayish-white. It phosphoresces on the application of heat, with a rich emerald-green light; and is hence included under the variety of *chlorophane*. With it, is intermingled a grayish white feldspar, minute scales of mica, and occasionally very perfect crystals of an almost emerald-green beryl. In those parts of the vein where the white topaz is abundant, the fluor is in larger individuals and nearly transparent, at the same time showing other tints, as bluish-green (336), dark purple and black (335) and reddish-white (337). The dark purple variety frequently forms thin coatings on the topaz and mica-crystals, and disseminates itself also between their laminæ.

Small quantities of purple fluor have been noticed with calcareous spar and quartz in the plumbaginous mica-slate in Newtown, at the diggings for coal on the east side of the brook. A similar variety occurs in the reddish granitic-gneiss at East Haven near the light-house (339). The brown shale of Berlin (588) occasionally presents the same mineral in connection with dolomite-crystals and bitumen.

Apatite is a more widely diffused species than has perhaps been imagined. There are few extensive granite-regions in the State in which it is altogether wanting, though the crystals are sometimes so minute and pale as to be with difficulty distinguished. It has also been observed in the secondary conglomerate of East Haven, and in the garnet-sand in the same town, at the light-house. A few of its most interesting localities however, only, will be mentioned. The china-stone quarry at Middletown affords it in short six and twelve-sided prisms, from one quarter, to above an inch in diameter. Their color varies from pale reddish white, through bluish white to asparagus-green (341*y*); and where penetrated by uran-ochre they present a citron-yellow color. At Haddam, the nests of albitic granite in the gneiss at Allen's vein yield it abundantly, in small bluish green, nearly transparent crystals (340*y*). The beryl-granite of Monroe contains occasionally, very perfect pale bluish-white crystals of apa-

tite; and the coarse grained albitic granite of Plymouth (340) presents it in brilliant, transparent, yellowish green crystals. Long, slender, bluish white prisms (340*b*) are found in granite-seams traversing a micaceous gneiss, at a place two miles north of Waterbury, where stone has been quarried for the erection of a button-manufactory. Thin bands of reddish white feldspar in gneiss contain a pale blue variety (340*r*) at Winchester, one mile southeast of Winsted.

Genus 5. *Lime-Haloide.*

Arragonite is a species but little known in the State, and is confined to secondary rocks, or occurs in situations where its formation is recent and still in progress. White drusy varieties of it are found in many of the red sandstone-quarries, as at East Haven (342*b*), East Windsor (343*b*) and Hamden; long acicular crystals on cupreous slate in Suffield at Enfield bridge (344*b*); filling up thin cross-seams in the calcareous mica-slate of Bolton mountain (341) and between layers of albitic gneiss in Haddam, Chester and Hadlyme.

Calcareous Spar.—Crystallized varieties of this species are uncommon in this region. Cross-seams in the bituminous limestone of Southington and Southbury rarely offer examples of the inverted rhomboid; and the agate-balls found in the trap of Southbury, Middlefield and a few other places, present small crystals of the form, metatastique. The marly shale of South Britain embraces layers of fibrous limestone. The large and easily cleavable individuals, to which the term calcareous spar was formerly restricted, have been observed only in agate-balls at Middlefield and in veins in trap at Berlin (347). The curved lamellar variety (*argentine*) occurs in small quantity in Monroe. Granular limestone exists in several well developed beds, particularly in the towns of Derby (342, 343), Trumbull, Watertown (345), Brookfield (345*b*), North Milford (344), Vernon (347*b*), Danbury (347*y*) and North Canaan. In most of the localities west and northwest of Monroe, the limestone is closely associated with dolomite. This is particularly the case at Reading, Danbury, Brookfield and Canaan, nevertheless beds of greater or less extent of pure limestone are found in these places. White and gray limestone, sometimes pure and sometimes mingled with dolomite and serpentine, occurs in Milford and New Haven, at the green marble quarries (229, 230, 231, 232, 233).

Narrow seams of white limestone traverse the argillite of Amity and Woodbridge (167, 168). Grayish black, bituminous limestone (292) occurs at Durham in Saw-mill brook, associated with bituminous slate (278*b*): and the same rock, but more compact and of a lighter gray color, is found in Southington (290, 295), Southbury (288) and Guilford (296, 297*b*).

Dolomite in well-formed crystals of the primary form, occurs lining seams in the white massive variety at Mead's quarry in Ridgefield (348); also occupying narrow seams (variety *pearl-spar*) in a bituminous brown shale at Berlin, near Hart's mills (354). The white granular dolomite is one of the most largely developed rocks in several towns of the northwestern part of the State, occurring in extensive beds associated with mica-slate, and rarely with pure limestone, in the towns of Salisbury, Canaan, Sharon, Cornwall, Kent, New Milford, Brookfield, Washington, Danbury, Reading and Ridgefield (349, 349*b*, 350, 350*b*, 351, 351*b*, 353). A single bed of dolomite occurs in the eastern part of the State in the town of North Stonington, near the line of Preston (218). It is also intimately blended up with limestone in the marbles of Milford and New Haven (229, 230, 231, 232, 233). The reddish brown massive variety (*brown spar*) forms narrow seams in sandstone-slate at Berlin, near the village of Worthington (355, 356), and in gneiss at Norwich (356*b*). A white massive dolomite enters largely also, into the composition of trap at Durham, two and a half miles south of the village on the Middletown and Hartford turnpike (316*b*).

Order II. Baryte.

Genus 1. *Parachrose-Baryte.*

Diallogite.—This rare ore of manganese is found in the town of Washington (New Preston Society), on land of Mr. Joel Camp. Its color is a dark carmine-red. It forms a thin pulverulent coating on *triplite* (358*b*).

Spathic Iron is a very abundant mineral in the town of Roxbury, forming with quartz a vein of many feet in width, and extending for upwards of half a mile up the side of a mountain, situated on the western side of the Shepaug river. It rarely shows itself under regular forms, but is massive in large, easily cleavable individuals (358). Its color, when freshly detached from the vein, is light yel-

lowish gray (357). Blende, galena, iron and copper-pyrites, are occasionally associated with it, in very small quantity (585*y*). Small quantities of spathic-iron occur likewise, at Lane's mine in Monroe.

Triplite.—A small bed of this rare ore is found in Washington on the farm of Mr. JOEL CAMP. It occurs in granite. Attention was drawn to it several years ago under the impression that it was an ore of iron, and a quantity of it was raised with a view to test its character. But its want of resemblance to the iron-ores of the country led to its neglect, and a considerable heap of the ore is now said to lie somewhere near the bed. It is much prone to decomposition on exposure to the weather; in consequence of which, it separates into irregular, feebly connected grains, whose surfaces are more or less coated by diallogite (358*b*). It is difficult to decide from the situation of the bed, whether the body of the ore is considerable.

Genus 2. *Zinc-Baryte.**

Calamine in the state of an impalpable powder of a white color, and in cellular, bone-like masses accompanies the blende and galena of Brookfield, in limestone (358*r*).

Genus 3. *Tungstic Baryte.*

Tungsten.—The only known repositories of this species in the United States exist in Monroe and Trumbull. At Lane's mine in the former town, it is by no means a scarce substance. It occurs both crystallized and massive in quartz and argillite (359). The crystals are large, but rarely perfect. The massive variety often occupies spaces of two inches in diameter. Its color is pale yellowish white, passing into gray. At Trumbull, it is situated in quartz near to the topaz-vein, and is attended with tungstic ochre and wolfram.

Edwardsite.†—This new species has been observed only at a single place, the falls of the Yantic at Norwich; and here in a very

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* *Electric Calamine*, though unknown as a natural production in the State, nevertheless occurred lining the chimney of an iron-furnace in Salisbury, in the form of thin crusts coated by small crystals (593).

† This species was discovered during the progress of the survey, and is named for his Excellency the Governor of the State (see American Journal of Science and Arts, Vol. xxxii, p. 162). The following is a brief account of its properties: primary form, oblique rhombic prism of 95°; cleavage parallel to the base uneven, in the direction of the longer diagonal, perfect; lustre vitreous to adamantine; color hyacinth-

limited quantity. It occurs in small, brownish or hyacinthine red crystals (359*b*), disseminated through bucholzite, in a red feldspathic granite, contained in gneiss. The crystals are rarely above a quarter of an inch in length, and one-sixth of an inch in thickness.

Genus 4. *Hal-Baryte.*

Heavy Spar attends the ores of copper generally in the secondary of the State, and is found also in the copper-mine at Bristol. The most abundant locality of this species is in Cheshire, about two and a half miles southeast from the village. It forms veins in sandstone at this place, one of which cuts directly across the highway with an average width of three feet. Half a mile from this, in a westerly direction on the road leading to the Cheshire turnpike, appearances of the same vein come into view near the road. The mineral is here more crystalline in its texture, and is accompanied by crystallized quartz. Numerous very perfect and transparent crystals, were formerly furnished by this locality (see figures 228, 232, 233, 234, 235, 236, 237 of my Mineralogy). Apparently the same vein, (at a place half a mile farther west, where a trench several rods in length and many feet in depth has been excavated for copper) affords large quantities of the massive variety, in broad lamellar individuals, and rarely also, crystallized specimens (360). It is frequently blended with quartz-crystals and green malachite (362). Heavy spar is like-

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red to reddish brown; streak white; transparent to translucent; hardness=4·5; specific gravity=4·2 to 4·6. Alone, before the blowpipe, in very thin fragments, it loses its red color, becoming pearl-gray with a tinge of yellow, and fuses with great difficulty on the edges into a transparent glass. With borax in little fragments, it turns white and gradually dissolves, forming a globule which is bright yellowish green while warm, but colorless when cold. When powdered, it is acted upon very slowly by aqua regia. A small quantity placed on platinum-foil and moistened with sulphuric acid, tinges the flame of the blowpipe green. It consists of

Protoxide of cerium,	56·53
Phosphoric acid,	26·66
Zirconia,	7·77
Alumina,	4·44
Silicic acid,	3·33
Protoxide of iron,	a trace
Glucina,	"
Magnesia,	"
	98·73

wise found along with copper-ore in Bellamy's mine in Cheshire, and at Rocky Hill near Hartford. By itself also, it forms a vein six inches wide in trap at More's mill, Kensington parish, in Berlin. The excavations for coal at Sandy Hook, Newtown, on the east side of the brook, furnish samples of heavy-spar, associated with quartz, fluor, and green talc.

Genus 5. *Lead-Baryte.*

White Lead-Ore has been noticed only in a few small crystals at the lead-mine in Brookfield, associated with galena, blende and calamine.

Genus 6. *Copper-Baryte.*

Blue Malachite.—Minute quantities of this species attend the copper-ores generally. A few distinct samples of it have been obtained from Rocky Hill, near Hartford, where it was found in quartz-veins, associated with variegated copper, green malachite and bitumen (320).

Green Malachite almost invariably accompanies the copper-ores, wherever they occur throughout the State. Crystallized varieties are uncommon. At the most westerly copper-diggings in Cheshire, specimens are found, exhibiting globular and botryoidal shapes (362) implanted upon quartz and heavy spar. Fascicular aggregations of delicate crystals have also been noticed at Bristol, though its prevailing condition at this place, is pulverulent (362*b*), which is the fact also at the copper-mine in Hamden, in Granby and in Manchester (363, 365). It is an impalpable coating likewise at Suffield (Enfield bridge), on cupreous slate (344*b*), and at Orange (366).

Order IV. Mica.

Genus 1. *Euchlore-Mica.*

Uranite presents itself occasionally in the china-stone quarry at Middletown, in minute tabular crystals and thin scales of a siskin-green, or lemon-yellow color. It is attended by pitchblende, uranium ochre and apatite (367).

Genus 4. *Iron-Mica.*

Vivianite has been detected only in a few instances as imparting an indigo-blue color to clay. It thus occurred at Manchester (330*b*), and at the Ore-hill in Salisbury.

Genus 5. *Graphite-Mica.*

Plumbago.—This species attracted attention at a very early period, in the town of Ashford, where it appears to have been explored to some extent. The original excavation is now concealed by a large stone-heap, and by a public highway. Plumbago however, is frequently to be noticed in small scales disseminated through the gneiss, both in place and in loose blocks, at various places in a southwesterly line from the black lead-mine in Sturbridge (Mass.), through Union, Westford, Willington, as far as Mansfield and Hebron. It is found extensively also in Cornwall (369, 370) near the Housatonick river, where it occurs in gneiss, taking the place of mica in the rock (74), and likewise associated with pyroxene. It has been met with also in Bethany (371), in Reading near Foster's factory, in Danbury one and a half miles above the village, and at Vernon in the flag-stone quarry (368).

Genus 6. *Talc-Mica.*

Talc in a highly crystalline condition is but little known in the State. Minute, yellowish white hexagonal plates are sometimes observable, implanted on crystallized mica at the topaz-vein in Trumbull, and in crystals of the chloritic variety, having the shape of double cones applied base to base, in Monroe. The slightly cohering, small, scaly variety of a blue color, (called *nacrite*,) is found at Mead's lime-quarry in Ridgefield (372), and common chlorite in Newtown (375) and Norwich (372*y*). Slaty chlorite exists in Litchfield (373*y*) containing broad scales of black mica; and chlorite-slate constitutes an important geological formation in Orange, Milford and Woodbridge (186, 187). Chlorite enters largely also into the composition of the chloritic granite of Lebanon and North Stonington (107, 127*b*). Glazings of white talc coat the cleavages of the topaz-vein at Trumbull (376), and the chrysoberyl-granite of Haddam (10). A talcose slate both green and gray (373, 374) occurs in Somers, another in Wilton (212) and another in Bristol (215). The last mentioned contains irregular seams of compact talc (376*y*). The trap of South Britain embraces, in some places, spherical masses of radiated chlorite.

Mica.—This important species, though a widely diffused ingredient of most of our rocks, is nevertheless not remarkable for interesting mineralogical varieties. The Middletown range of large grained granite however, is not without some interest in respect to its varieties of mica. A grayish brown variety with a shade of green, which is often in large distinct crystals and in coarse granular massive individuals (377) as well as in broad foliated plates, is common at the china-stone quarry. The same range, but near the lead-mine in Middletown, produces in small quantity a large grained, pink colored variety (*lepidolite*). The mica of the topaz-vein in Trumbull, is sometimes found in large distinct crystals, implanted on quartz. A perfectly white mica in small scales, is found in the Watertown limestone (378) and likewise in the quartzy mica-slate of Stafford (171).

The quartzy mica-slate at Killingly (178) contains a variety in hair-brown scales. Black mica in large plates occurs in the albitic granite of Plymouth (9): it is also abundant, but in small scales, in the albitic gneiss of Madison (67*b*), Chester and Haddam (94*b*). A variety of the same color, but occurring in elongated parallelograms, abounds in the fine-grained, flesh-colored granite of Upper Mystic (44*b*). A light greenish gray mica in curved laminæ, enters largely into the composition of the mica-slate of Roxbury (146), while the mica of the Bolton mica-slate is of a shining silver-gray (141*b*). The variety *pinite*, often crystallized, but more commonly massive, is found in the chrysoberyl-granite at Haddam (379).

Genus 7. *Gypsum-Mica.*

Gypsum.—The trap of Cheshire and Middlefield very rarely embraces thin, transparent laminæ of this species, which occupy the cavities of agate or zeolite-geodes. It also presents itself as a secondary product in small radiating crystals, on the decomposing pyritous magnetic iron-ore of Washington.

Order V. Picrosmine.

Genus 1. *Atelene-Picrosmine.*

Serpentine in small, green crystalline individuals, is found disseminated through the dolomite of Ridgefield at Mead's lime-quarry (380). The precious serpentine of oil and siskin-green colors (381) occurs entering into the composition of the Milford and New Haven

green marbles. At the Milford quarry, nodular masses of black serpentine (230) are found, and which impart to the rock its verd antique character. Black serpentine forms extensive beds also in Greenwich (236), Litchfield (237*b*) and Winchester (236). It occurs besides, in boulders very frequently in the western part of the State.

Picrolite.—This fibrous, asbestiform mineral is very abundant in the New Haven green marble-quarry, where it presents several varieties of structure and color. It sometimes occurs in large and slightly curved, fibrous individuals of a yellowish white color. It also forms strait, parallel, silky fibres, intermingled with white dolomite (383), and again in almost imperceptible, brownish gray fibres (382*b*). It is less common in the Milford quarry, but occurs at Stratford (near the mouth of the harbor) in veins traversing serpentine-rock. It here possesses a fine columnar, or fibrous texture, and a leek green color (382).

Order VI. Spar.

Genus 2. Disthene-Spar.

Kyanite is found in rolled masses in the towns of Litchfield and Washington, often of considerable size, and altogether composed of this mineral, with the exception of thin layers of white talc and occasional grains and crystals of corundum. It is without doubt derived from the mica-slate of the region, although as yet it has not been discovered in place. The mineral is in broad, rather short columnar individuals, aggregated in a confused manner, and possessing a delicate, pale berlin-blue color (387). Detached masses of a similar variety, though of a deeper blue color, occur in Plymouth (387*b*). The mica-slate of Oxford near Humphreysville, abounds in nests of a semi-transparent quartz sometimes eighteen inches in diameter, which are thickly traversed by crystals of kyanite. The mica-slate of Vernon and Bolton probably contain this mineral under similar circumstances, as boulders of it are found in Bolton (385) and Coventry (386). A grayish white variety in slender curved prisms, was found disseminated in small quantity through gneiss in Chaplin (388). Indeed kyanite is to be found in small crystals occasionally, throughout the mica-slate ranges of the State; but the places above mentioned are the only ones appearing to possess much mineralogical interest.

Spodumene is found in Brookfield, a few rods north of Tomlinson's tavern. It enters in small quantity, into the composition of a feldspathic granite (389) in the form of small nearly transparent, grayish or greenish white individuals, which are with difficulty distinguishable from feldspar.

Genus 3. *Dystome-Spar.*

Datholite.—This interesting trappean species is unusually abundant in Connecticut. Six localities are already known; and when the trap shall have been fully explored, the number will doubtless be much increased. It has been noticed perhaps, in the largest quantity at the Rocky-hill quarry, Hartford; where it exists crystallized and massive in seams, sometimes nearly an inch in width (391, 392). The amygdaloid in the northeast part of Southington, near the house of Mr. HAMLIN, abounds with the mineral in several varieties; crystallized, massive in large granular individuals, and in delicately diverging individuals (390, 393, 394). The larger cavities in the trap contain also, transparent calcareous spar; and the rock itself abounds in light colored chloritic globules, imparting to it an oolitic appearance. It exists also in the amygdaloid of Berlin (near Kensington), and farther south in the northwestern part of Meriden, and in Middlefield (at the falls). It has also been observed at the Roaring brook in Cheshire.

Genus 5. *Kouphone-Spar.*

Prehnite in very perfect crystals, associated with chabasie, was formerly obtained in trap at Farmington, near where the canal is taken across the Farmington river. The trap range just east of Woodbury, abounds in balls and veins of prehnite (395). It is here found in reniform, globular and stalactitic shapes of a pale greenish-white color. It occurs also in small quantity in numerous places throughout the trap-range, as in the vicinity of New Haven, Cheshire, Middlefield falls, Berlin, Simsbury and Southbury. It is also found distinctly crystallized in a chloritic slate, altered by a trap dyke (396), near the line of New Haven and Woodbridge.

Analcime, in small, though distinct, trapezohedral crystals (398) is found in the trap of Black-rock, East Haven.

Chabasie.—This is a rare mineral in the trap of the State, having only been observed at Farmington and Cheshire, in both places attended by prehnite. It occurs in yellowish white crystals along with stilbite, heulandite and garnet at Hadlyme in the flagging-stone gneiss; also at the Paugatuck stone-quarry in Stonington, both massive and crystallized (399), associated with scapolite, sphene and apatite. A massive variety of a yellowish-red color in granitic gneiss, is found in North Killingworth on the Essex turnpike, where it crosses the Hammonasset river.

Laumonite is found in considerable abundance, both massive and crystallized, filling up narrow seams in gneiss at Bradleysville in Litchfield. The mineral is brought into view, by the excavations made in the construction of a raceway for a paper-mill. Its color is white, and its lustre pearly (396*b*). A somewhat analogous variety is found in Southbury, a little east of the village, on land of Mr. STILES. A mineral also which appears to belong to this species, occurs in the town of Woodbridge, about seven miles from New Haven, on the Humphreysville turnpike, in a ledge of mica-slate, which has been excavated to some extent in making room for the highway. It is in seams of gray quartz, and is accompanied by calcareous spar and massive garnet. It is nearly colorless and transparent, consisting of an aggregation of small crystalline grains, partially elongated in their figure, and exhibiting under the microscope distinct cleavages. On exposure to the air for a short time, it loses its transparency, and gradually falls to the condition of a powder which has a pinkish-white color (594*b*, 595*b*). Laumonite is found occupying thin seams in trap at East and West rock near New Haven, and probably at many other places in the same formation.

Mesotype has been found in small quantity in very perfect crystals, upwards of an inch in length at Cheshire (see figures 292 and 293 my Mineralogy), where it occurred in trap associated with prehnite and chabasie. It occurs in the same rock, in radiating closely aggregated fibres at Humphreysville; and of a similar structure on gneiss, at Washington and Hadlyme (397*b*).

Stilbite in very minute, yet well formed crystals, is plentifully found in thin seams traversing the trap of Black-rock in East Haven (400.) Its color is white. A similar variety occurs in the gneiss-quarry at Thatchersville near Bridgeport, lining small cavities in a

large-grained granite (401). It is also found at Hadlyme on gneiss, in columnar radiating individuals (401), associated with epidote, garnet, scapolite and apatite.

Heulandite has merely been detected in a few instances, along with stilbite and chabasie at Hadlyme.

Genus 7. *Feldspar.*

Feldspar.—Next to quartz, this is the most abundant species in the State. It is rare however here, as it is in all other countries, to obtain it in well defined crystals. The china-stone quarry in Middletown, occasionally affords imperfect crystals of the *sexdécimal* figure, a foot in length and six or eight inches in thickness,—the elongation of the crystal taking place in the direction of the edges formed by the meeting of the planes P and M, and which incline to each other under 90°. The color of this feldspar is white with a slight tinge of yellow (410*b*). Crystals of feldspar from two to three inches long by one inch in thickness, of the same general figure as above described are abundant in the western part of Litchfield, near Bradleysville, imbedded in albitic gneiss (402*b*). Their surfaces are coated with scales of black mica; and when broken, they are seen to be permeated throughout, by the same substance. Small crystals of the form *binaire*, were found about one mile north of Canterbury on the road to Chaplin (402). Crystals have been noticed also in a few instances, in various parts of the State, lining the sides of small cavities in granite; but as these occurrences were so isolated and unimportant, they do not require enumeration. A white translucent feldspar in large individuals, occurs at several places in the southwestern part of Greenwich (408, 409). Flesh-colored varieties also, in large individuals occur in the same town, associated with albite and tourmaline (403). A very glassy, flesh-red variety occurs at Thatchersville near Bridgeport, associated with hornblende, quartz and stilbite. A deep flesh-red feldspar is found at New Canaan (405) and at Stonington point (15*b*); while a variety almost brick-red is found between Wolcottville and Winsted (13*b*). The sun-stone (a variety which in certain positions with regard to the light, exhibits reddish and variegated patches of light) is found in Lyme. Adularia, a variety exhibiting a bluish opalescence on the face of its most distinct cleavage, occurs at the falls of the Yantic in Norwich,

attended by bucholzite and edwardsite (404*b*). A dark purple feldspar enters largely into the composition of the green chloritic granite of Groton (406*b*). Green feldspar is found in Bolton (413). A dull, yellowish gray variety (405*b*) which on account of its peculiarity merits further attention, is found at Reading near Danbury, at the garnet and pyroxene-locality. Fetid feldspar is disseminated in seams and nodules through dolomite in Brookfield, a quarter of a mile north of TOMLINSON'S tavern (415) and at Danbury near Col. WHITE'S factory (416*b*). Fine granular feldspar is frequent in the eastern part of the State in Voluntown, Plainfield, Sterling, North Killingly and Thompson. Decomposed feldspar (*kaolin*) either pure or mingled with decomposed albite, abounds in New Milford, Kent and Cornwall. It has been observed also in very small quantity in Granby, Bristol and Killingly.

Albite.—This species enjoys a distribution much greater than has been supposed. In a crystallized state however, it has only been observed at the china-stone quarry in Middletown. It is abundantly found at this place, lining cavities in small translucent or transparent crystals, both simple and compound (424). The massive variety is found here also, both by itself (425) and intimately associated with feldspar (411). In the latter case, the most distinct cleavage in both species is so arranged in the same direction, as to render the two minerals difficult of distinction, except by means of a slight difference in color. Fine granular albite (426) is also common in this quarry. A very handsome variety of albite in large, greenish white, semi-transparent individuals (426*b*) is abundant in Haddam, about half a mile southwest of the court-house. It is associated with tourmaline, forming a large grained granite. It sometimes exhibits the bluish opalescence peculiar to adularia. But the most delicate white variety of this species is that, so common in the coarse grained granite of Plymouth (427). Occasional beds of this variety are found in Watertown, Bethlehem, Harwinton, Burlington, New Hartford, and Canton. The coarse grained, red feldspar-granite of Greenwich (8), includes large individuals of albite. Nor is albite less prevalent among the different varieties of granitic gneiss, as well as among the fine grained, stratified granites. Suffice it to mention in the way of localities in these rocks, the gneiss-quarries of the Connecticut river at Middletown, Haddam, Chester and Hadlyme. To a very great

extent in this region, it is noticeable that the gneissoid granite contains no feldspar, excepting where it is cut across by granite-veins. The interstratified portions, though large grained and coarse, still exclude feldspar (424*b*); but wherever a cross-vein occurs, the albite is completely replaced by feldspar (16*b*).* The adularia variety of albite occurs in nodular masses in the micaceous gneiss of Thompson (426*y*), in the pyritous gneiss of Chaplin (426*r*), and of Union (427*b*). The porcelain-clays of New Milford, Kent and Cornwall, are largely indebted to this species for their origin.

Genus 8. *Andalusite-Spar.*

Andalusite has only been found in detached, quartzy boulders in the towns of Litchfield and Washington. It was crystallized however, in forms of unusual size and perfection. It is therefore probable that important localities of this interesting mineral will eventually be discovered in the mica-slate of these regions.

Genus 9. *Petaline-Spar.*

Scapolite occurs at several localities in the State, without being found any where in abundance, or in well crystallized varieties. It is the most largely developed at Trumbull in the limestone, near the topaz-vein, where it is associated with garnet and epidote (432). The massive character prevails in it at this place, though imperfect crystals sometimes present themselves. Its color is white. It is found massive in large individuals, and with a tendency to decomposition at Stonington, in the stone-quarry at Paugatuck. In becoming decomposed, its color assumes a shade of pink (434). It also occurs at this place in small crystalline grains, resembling tabular-spar (435). Garnet, sphene, chabasie and apatite, are associated with it, in the granite. Scapolite occurs lining the walls of fissures in the gneiss-quarries of Hadlyme (401*b*), of the hornblendic gneiss of Norwich, and of Canterbury (432*b*), near the line of Plainfield, and in layers with pyroxene at the notch of the Bolton mountain (433).

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* It is observable moreover, that the minerals contained in the albitic gneiss and the granite intersecting it, are different. The latter contains beryl, garnet and tourmaline, the former apatite and molybdenite. These facts are particularly illustrated at the Allen-vein in Haddam.

Genus 10. *Augite-Spar.*

Epidote.—The beautifully crystallized, pistachio-green varieties of this species occur, filling up seams in the granite-gneiss quarries of Hadlyme and Chester (437*b*). Granular epidote (*scorza*) of the same color, is common in the albitic gneiss at Higganum in Haddam (438*b*), and the massive variety abounds in irregular seams and veins in the hornblendic gneiss of Thompson, Killingly, Brooklyn, Plainfield, Griswold and Preston. It is also frequent in the chlorite-slate of Milford. It enters as an ingredient in small quantity, into the granites of Chatham and Glastenbury (62). A well crystallized, yellowish gray epidote occurs at Trumbull near the topaz-vein, filling up cavities and occupying seams in a massive green hornblende (436). The crystals are imbedded in calcareous spar, and possess a high lustre and much perfection of figure. A pearly variety (*zoisite*), both crystallized and massive (438), has been found in Monroe. Zoisite also occurs in rolled masses in the Milford range of green slate; in which rock it has been found also, associated with yellow copper-pyrites, and occupying quartz-veins. The same variety occurs likewise, to some extent in the mica-slate of Vernon (441), at the flagging-stone quarry. A dull greenish-gray variety, both crystallized and massive, is met with traversing a hornblendic gneiss, in the northwest part of Woodbury (437).

Pyroxene.—This species is developed in the state nearly to the same extent as the preceding, and yet it is by no means common in the crystallized condition. The most distinct crystals are the flattened white prisms disseminated through dolomite in Canaan. They are often possessed of considerable dimensions, being two or three inches long, by one or two in breadth. Their shape is illustrated in figures 353 and 354 of my Treatise. They are found in the dolomitic sand, as well as in the undecomposed rock, near the post-office in Canaan. Large green crystals in eight-sided prisms occur in the blue limestone of Trumbull (442), while transparent ones of very minute dimensions (*fassaite*) attend the fine granular, green pyroxene (*coccolite*) of Reading, on the turnpike, near the line of Danbury (445*y*). Massive, broad lamellar varieties in large individuals (*sahlite*) of a white color (442*b*) are found in Watertown, at the lime-quarry near the Naugatuck, and of a dark greenish gray

(443) in the green marble-quarry at New Haven. A grayish hair-brown variety (443*b*) occurs in seams contained in gneiss, with garnet and magnetic iron-pyrites, between Stafford and Union. The quarry of flagging-stone at Vernon contains a light bluish green, massive pyroxene (445). A similar variety occurs with massive hornblende in Plainfield (444*b*). A green massive variety is found abundantly in Sharon (445*b*) on Buck's mountain, associated with magnetic iron. This variety is of frequent occurrence in the gneiss of the northwestern part of the State. A massive, compact, stratified, white pyroxene* (445*r*), abounds in North Canaan, on both sides of the Housatonick river.

Hornblende.—The white and grayish white, semi-transparent variety (*tremolite*) is almost the only one which assumes with us the crystallized state: nor does this afford crystals perfect, except in their lateral faces. The dolomite of Canaan, between the falls and the post-office, is rich in this variety (447, 448). It also occurs in the marble-quarries of Washington (448*b*). At the first-mentioned locality, it is usually attended by white pyroxene; and at both, it is accompanied by other varieties of the present species, especially by the fibrous tremolite. At the marble-quarries, the fibres often become silky and are much interwoven, giving rise to what is called *paper-asbestus* (467, 466*b*), and when the masses are thick and coriaceous to mountain-leather (468). A black variety in broad, compressed prisms (449), and an acicular one of the same color (456) occur in Torrington. A massive, shining black, easily cleavable variety (*carinthin*), associated with greenish gray pyroxene is abundant a little north of the village of Danbury (450, 451, 452). The grayish black, massive variety with metallic reflections (*hypersthene*), is found near Bradleysville in Litchfield (457.) The brown, slender, curved and sometimes interlaced crystals (*anthophyllite*) in granitic gneiss, are found at Haddam one mile north of the Court House, also a little west of the village along with iolite, and in Guilford two miles north of the centre (458). The grayish white, radiating, fibrous variety (*asbestiform tremolite*) is common in Greenwich (461), Winchester (462), Litchfield (465), Wilton and New Hartford. The

* This mineral was originally described by Prof. HITCHCOCK as scapolite, and was afterwards referred to by myself, as saussurite.

fibres are sometimes long and parallel, as at the locality in Winchester (466). Common massive, black and greenish black, hornblende (454) enters largely into the composition of the sienite of Litchfield; and into the hornblendic gneiss so abundant in Preston, Griswold, Canterbury, Plainfield, Brooklyn, Killingly and Thompson, not to mention its occasional presence in all the varieties of gneiss, and the part it plays in the secondary trap of the State.

Genus 11. *Tabular Spar.*

Tabular Spar in very limited quantity, is associated with quartz and calcareous spar, at the place in Brookfield where an excavation was made for copper-ore. It is massive, and in large individuals of a white color (469).

Boltonite is found in Ridgefield at Mead's lime-quarry. It occurs in yellowish or bluish gray grains disseminated with mica, through dolomite (470), and at Hill's quarry in Reading, of a pale straw-yellow color (471*b*). Boulders of the same mineral are common in Danbury (471).

Order VII. Gem.

Genus 1. *Corundum.*

Spinel, in small black octahedral crystals, has been detected at Haddam, associated with chrysoberyl, beryl, garnet, &c., at the well known locality near the meeting-house.

Automolite is found at the same place, with the last mentioned species. It presents a dark green color, with a tinge of blue (471*y*), and occurs both crystallized and massive.

Genus 3. *Topaz.*

Topaz.—Of this precious substance, a very remarkable locality exists in the town of Trumbull. It here forms, along with fluor, magnetic iron-pyrites and yellow copper-pyrites, a vein of considerable dimensions, cutting across a micaceous limestone. The rock has a northerly direction with a dip of 15° west. The direction of the vein is north, 20° west, and its dip is from 75 to 80° east. The topaz forms from ten to eighteen inches of the more central part of the vein, where it is much blended up with fluor, mica, quartz, talc, magnetic iron-pyrites, and yellow copper-pyrites; and on each side

this aggregate is bounded with fluor to the thickness of from six to twelve inches. The topaz forms a large proportion of the vein, so far as it has been opened, which is for several rods in extent, and to the depth of from five to ten feet. It is rarely crystallized with high degrees of perfection, though the lateral primary planes and several of the pyramidal faces, are more or less distinguishable. Among the smaller crystals, it is not rare to find those which are in a measure perfect and transparent* (473); but the larger ones are only semi-transparent or translucent. The size of the crystals is the most extraordinary feature of the locality. They often occur six and eight inches in diameter, with a length of from three to seven inches. The surfaces of the large crystals however, are generally rough; and often more or less coated by mica and flour, which last mineral often penetrates the substance of the crystals. The prevailing color is white (474), excepting in those parts of the vein where the species of pyrites above mentioned abound; here, the crystals assume a dark greenish tinge (475). There can be but little doubt, that this vein when thoroughly laid open, will yield all the varieties of the species in great richness and perfection.

Genus 4. *Emerald.*

Beryl, though not so abundant perhaps as might have been anticipated from the primitive character of the State, is still found at several places in considerable perfection. A coarse grained granite in the northwestern part of Monroe, has afforded the most interesting variety of well crystallized and handsomely colored beryl (476, 478). The crystals, which are greenish white and very thickly disseminated through the rock, are generally from one quarter to three quarters of an inch in diameter, much elongated, and often bent either by a gradual curvature or else by a slipping of the cross laminæ successively towards one side, throughout the entire length of the crystal. More perfect crystals of a richer green, approaching that of the emerald, have very rarely been met with in the fluor of the topaz-vein in Trumbull, some of which are surmounted at their extremities by highly polished facets. A single crystal of about one

* Representations of particular forms which have been detected at this locality, may be seen in figures 439, 440 and 441, of my Mineralogy.

inch in diameter was observed near the citre of Oxford, imbedded in granite. Middletown and Haddam arealso rich in the present species. In the china-stone quarry, large rystals of a greenish yellow color (479*b*) occur; and the same kid of granite continues to afford a similar variety at various points, qite to Roaring brook in Glastenbury. Here, in a bed of reddisl granite, a deep green variety of beryl is found (479). The ganite-veins of Haddam and Chatham also, furnish beryl in considerble abundance. At the chrysoberyl-vein near the meeting-house, crstals sometimes five or six inches in diameter, occasionally occur. They have a greenish yellow color, sometimes passing into wax-yelow; and are frequently penetrated by crystals of chrysoberyl. Thefeldspar granite of the Allen-vein quarry contains a bluish green berl (477), often in large crystals. They sometimes exhibit a very pecliar tendency towards an acute pyramidal termination, at one extremy. Two miles south of this place, a yellow, transparent and perfecty crystallized variety was formerly obtained, occupying a thin quartzvein in a very micaceous gneiss. The form of the crystal is repesented in figure 56 of my Mineralogy. The granite of Chatham mar the cobalt-mine, has also afforded crystals of the present species.

Chrysoberyl.—The most remarkable repository of this species known, occurs at Haddam. It is situated in tacy granite, two or three rods east of the meeting-house, and has been explored for twenty feet in length to a depth of six or eight feet, and for a breadth of nearly ten feet. The granite, which is mostly albitic, abounds in precious garnet, and contains also yellow beryl, columbite, zircon, automolite, &c. The chrysoberyl occurs in large distinct crystals, simple and compound (see fig. 136 of my Mineralogy) as well as massive (480), imbedded in albite, beryl and garnet. It is semi-transparent, and its color is olive-green.

Genus 5. *Quartz.*

Iolite is found in Haddam in the albitic granite, half a mile southwest of the court-house. It occurs in large massive individuals, having one very eminent cleavage. Its colors are various shades of blue and green, the former predominating (481); it is transparent in spots, and possessed of dichroism. It is obtained at this place with some difficulty, and does not promise to be abundant. A less

pure variety intimately blended up with quartz, anthophyillite, garnet and mica, exists in gneiss (482) at a place in the highway on the hill, a little west of the village. But a much more abundant source of this mineral may be indicated, as existing between the Shetucket river and the Quinebaug, and within a few rods of the Norwich and Worcester rail-way, where the gneiss-rock has been extensively blasted out to make room for its passage. It is massive, in large individuals (482*b*), semi-transparent, and possessed of a deep indigo-blue color. It is immediately imbedded in quartz and attended by a blood-red massive garnet, and a singular variety of feldspar having a pale yellowish green, pinkish red and cinnamon-brown color. It is semi-transparent, and occurs in masses about a quarter of an inch in diameter. Its lustre is vitreous, and its specific gravity is between 2·4 and 2·7. Its hardness = 7·0. Before the blowpipe in small fragments, it fuses with difficulty into a semi-transparent white glass.

Quartz.—In treating of so universal a species, it will be proper to notice only a few of its more interesting varieties. Long slender, semi-transparent crystals (483) abound in the soil of a hill, one mile southwest of Haddam village. They are evidently derived from the walls of fissures, or cavities in granite, to which they were attached by one extremity. They vary from one to five inches in length, and are often aggregated laterally into groups. A somewhat similar variety but in much larger crystals, occurs in the northeastern part of Thompson. Large tabular, semi-transparent crystals in compressed prisms, occur in Mead's lime-quarry in Ridgefield (485). Minute doubly terminated crystals, are found imbedded in the compact gray limestone of Northford (484). Drusy quartz associated with limonite (487) and ferruginous jasper, abounds at the ore-bed in Kent. Crystals of the purple variety (amethyst) are occasionally found, lining geodes in the trap of Woodbury, Southbury, Berlin and East Haven. A large accumulation of crystallized and drusy white quartz, occurs in boulders on Whortleberry hill in Canton (493*b*). A coarsely columnar variety at this place is sometimes striped with pale purple (491*b*). Large boulders of a drusy and white columnar quartz, sometimes containing galena and blende, are common in the diluvium of Plymouth. Rose-colored quartz (492), is found occasionally in the china-stone quarry in Mid-

dletown, and apparently constituting an extensive bed in the southwestern part of Southbury. Milk-white, common quartz exists plentifully in Roxbury, in boulders, as well as in veins and beds in mica-slate (489). It is also abundant in the argillite of Woodbridge (488), on the Litchfield turnpike. Calcedony is found in small nodules, and forming the walls of geodes at numerous places in the trap region, especially at Woodbury, Southbury, Farmington, West Hartford, Berlin and East Haven. In these places, it is often banded with milk-white opal, forming the common fortification or onyx agate (495, 496, 497). At Southbury, it presents itself in veins, stained of a dark green (501). A similar variety is found at Cheshire (498). Botryoidal calcedony, of a yellowish and reddish white color (504), is frequent in the clay and iron-region of New Milford, Kent, Cornwall and Washington. It is found in the immediate vicinity of some of these depositories in large boulders, and scattered also through the diluvium of Goshen, Torringford, Washington, Litchfield, and sometimes still farther south.* Several masses of genuine carnelian have been found in Torringford (504*y*). A yellow jasper occurs in the New Milford clay-bed (503). Yellow ferruginous quartz (495*b*) exists at the Kent ore-bed, together with a drusy cellular variety (494*b*) which is sometimes so light as to swim for a moment, on the surface of water. A pseudomorphous quartz (493) is found in a large quartz-seam near Straitsville in Prospect.

Opal.—Slight intermixtures of this species throughout the State, attend all the striped and milky calcedony, whether occurring in the

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* The source of the calcedonic and jaspery concretions in the vicinity of the porcelain-clay repositories and limonite ore-beds is, without doubt, connected with the decomposition of the feldspar and albite from which the clay and "gray fuller's earth" originated. The silicic acid of which the varieties of quartz in question are composed, was brought into solution by the liberated alkali, and subsequently precipitated by the access of carbonic or sulphuric acid. That this was the case appears most probable from the fact, that analysis rarely finds the silicic acid in such clays, bearing so high a ratio to the alumina as in the original minerals, evincing that some portion of the acid has been withdrawn in a soluble state along with the alkali. The same explanation extends to the hyalite, found lining fissures in the conglomerate of Hamden, in which are found cavities occupied by a green clay; likewise to the formation of hyalite in the feldspar-granite of Haddam. And possibly we may be authorized in adducing a similar explanation for the origin of agates in trap, through a partial decomposition of the feldspathic ingredient of the rock.

trap or found in the diluvium. In addition to which, small reniform and botryoidal coatings called hyalite, occur lining the sides of fissures in feldspar-granite at Haddam (505), also interposed between the strata of conglomerate-sandstone at North Haven (508), forming a pellicle over cellular quartz at Rocky Hill, near Hartford (507) and on trap at Southbury (506), New Haven and many other places.

Genus 6. *Axinite.*

Bucholzite.—The variety of this species found at Chester in distinct crystals and in long, massive individuals, is chiefly known under the name of sillimanite, being regarded by some mineralogists as a distinct species. It is found in quartz-layers in gneiss (509). The same variety occurs to some extent in Norwich, both at the falls of the Yantic and at the manufacturing village one mile north of the landing. In the former place, it occurs principally in long, slender, fibrous individuals, and is accompanied by edwardsite and blue corundum (510, 510*b*). At the latter place, it is in large crystals and massive individuals, coated and interlaminated with talc, and attended by magnetic iron and flesh-colored feldspar in thin granite-seams (543*b*). Still another variety, much involved with talc, is found in Haddam, in albitic granite near the iolite-locality, half a mile southwest of the Court House (511), also in Groton near Upper Mystic (512), and in garnetiferous gneiss in the corner of Stafford, Union and Ashford (511*b*). It would appear also, that a locality exists in the western part of the State, inasmuch as a pebble of the compactly fibrous variety was found in the town of Oxford, near Humphreysville.

Genus 9. *Tourmaline.*

Tourmaline.—This is a frequent ingredient of the large-grained granites, and exists also in other rocks throughout the State. As meriting the most particular notice may be mentioned, the brownish black crystallized variety of Monroe (513, 514, 515), which occurs in crystals from one quarter of an inch to two and a half in diameter, with a length but little greater than their thickness. They occur thickly disseminated through a mica-slate, consisting almost wholly of mica, or of mica mingled with a little talc. These crystals are rendered particularly interesting from the perfection of their form, which is that of a six, or a nine-sided prism with trihedral ter-

minations at both extremities (see figures 443 and 444 of my Mineralogy). Very brilliant black crystals of a different form (see fig. 447 as above) are found in granite-veins in the same town. Haddam also affords very distinct crystals of this species, both black and brown. The black is found in the albitic granite southwest of the Court House, in crystals above an inch long. Many of them highly complete in their form, are corroded or pitted on their lateral faces. (For the form, see figure 445 as above). The brown variety is found in a talco-micaceous gneiss on Walkley hill, and is often attended by anthophyllite. The crystals are much elongated in figure, and channelled in an irregular manner on the surface (516). The white rocks of Middletown yield at one place, green and red, massive individuals and crystals of tourmaline: some of the latter possess great delicacy of tint. They are associated with albite and pink and green mica. On a side-hill in this vicinity, a single crystal of red tourmaline, one and a half inches in diameter, was found. A black fibrous variety occurs at the soapstone-quarry in Somers (519). The coarser varieties of granite usually present this species in greater or less abundance, and often in very large crystals, forming what has been sometimes called a shorlaceous granite (519*b*).

Idocrase.—A few crystals and grains of a reddish brown color have been detected in a micaceous seam of rock, contained in Starr's marble-quarry at Washington (519*y*).

Genus 10. *Garnet.*

Garnet.—For extent and wideness of diffusion, this mineral is perhaps entitled to rank next to the species hornblende. In much of the mica-slate, it nearly makes good the place of feldspar in gneiss, existing in crystals from a size so small, as to demand a microscope for detection, as in the Bolton rock, up to that of a grape, as in the Reading mica-slate. Granite and gneiss also frequently contain this species; besides which, it occurs in beds and veins by itself. It will be proper only to indicate a few places remarkable for peculiar varieties, and to allude generally to regions where more common kinds occur. The chrysoberyl-locality at Haddam deserves to be mentioned first. The variety here found is the precious garnet. It possesses a rich brownish red color, and is semi-transparent (530). It occurs in imperfect trapezohedrons, often an inch or two

in diameter, and sometimes penetrated by small crystals of columbite. A very rich cinnamon-brown variety of garnet constitutes an extensive bed in gneiss in Reading, on the turnpike, four miles south of Danbury. Detached masses of a ton's weight, are common by the road-side. It appears at several spots to be connected with the subjacent rock. It is generally massive, with a compact or impalpable structure, yet containing occasional cavities, whose walls are lined with rich transparent crystals, (523*b*). A fine granular, green pyroxene (445*y*) or coccolite, is sometimes associated with the garnet. A similar variety, but having a darker shade of red and less transparent, forms a bed in mica-slate in the south part of Plymouth, half a mile southeast of Hoadley's factory, where it was formerly explored to some extent, under the impression that it was an ore of iron (521*b*). The garnet contained in the mica-slate of Reading, Washington and Monroe, is sometimes peculiarly interesting from the size and regularity of form it possesses. They vary in size from a pea to that of a walnut; and have either the form of the trapezohedron, or a shape intermediate between this and the dodecahedron. One place in Reading has afforded them in such profusion, as to acquire the name of the garnet-rock. It is situated about half a mile northwest of the junction of the two largest branches of the Saugatuck, a short distance above the south boundary of the town of Reading. The mica-slate of Stafford, Bolton and Vernon (522, 528*b*), affords similar varieties. Indeed, this rock throughout the State is rarely wholly without garnet for any considerable extent. A delicate rose-red garnet in crystals of the size of a pea and larger, is common in beds of feldspathic granite (527*b*) in the corner of Union, Stafford and Ashford. A similar variety has been observed on the road between Hampton and Chaplin. The eurite of Norwalk (525) abounds in minute but well-formed garnets. The hornblendic gneiss with black mica of Preston, Norwich, Lisbon, Griswold, Plainfield, Brooklyn and Thompson (525, 526, 529*b*), contains a deep red garnet disseminated in imperfect crystals or grains, which approximates to the variety called *pyrope*. A rose-red, fine granular variety (*colophonite*), intermingled with quartz (527), is found in North Madison, half a mile east of the meeting house, forming layers, or beds in gneiss. Other localities worthy of enumeration are the following: large-grained granite in Guilford,

two miles northwesterly from the meeting house (524); china-stone quarry, Middletown; gray granitic gneiss of Guilford (526*b*), Allen-vein, with pyroxene in gneiss (524*b*); chlorite altered by trap in small yellowish green crystals (523); in sand at Millstone point, near New London (528), and at East Haven (529).

Zircon.—This rare mineral is found in small crystals at the chrysoberyl-locality at Haddam (530), and along with pitchblende and feldspar at the china-stone quarry in Middletown.

Staurotide is an abundant species throughout the State, being every where nearly co-extensive with the mica-slate. The most striking localities known, are in the Bolton mountain range, in the towns of Bolton, Vernon, Tolland and Stafford (533, 534). Next to this region may be mentioned the mica-slate of Salisbury and Litchfield (530*b*, 531*b*).

Order VIII. Ore.

Genus 1. *Melane-Ore.*

Allanite is found in granitic gneiss, in slender black prismatic prisms about an inch in length (534*b*), in the town of North Killingworth on the Essex turnpike, where it is crossed by the Hammonasset river.

Genus 2. *Eruthrone-Ore.*

Sphene accompanies pyroxene in calcareous spar at Trumbull near the topaz-vein, and occurs with the same species at Gold's mine in the north part of Cornwall (535). Other localities are the quarry at Thatchersville near Bridgeport, where it is associated with a greenish black massive hornblende (536), and the quarry near Paugatuck in Stonington, where it is associated with scapolite, apatite and chabasie. It was detected also in small quantity at Plainfield with pyroxene and hornblende in gneiss; and under similar circumstances at New London.

Eremite.—This is a species never before described.* It was found in a block of albitic granite on land of Mr. David Matoon,

* Its name is derived from ερημια *solitude*, in allusion to the fact that thus far but a small number of crystals have been found. It was discovered by Mr. Thomas R. Dutton, a member of the Senior class in Yale College.

three miles from Watertown on the road to Northfield. The largest crystal found weighs about six or eight grains. It is semi-transparent, of a rich clove-brown color, and has for its primary form a right oblique-angled prism of 140° 26′, modified by numerous faces on the terminal edges and angles. Its lustre is vitreous. In hardness, it is between apatite and feldspar. Its specific gravity is 3·714.

Rutile is found in considerable abundance in the eastern part of Monroe, in mica-slate (537). It here occurs in large, indistinct crystals and grains. The same rock has afforded this species also, in Bristol and Plymouth. A few crystals have been found in the northeastern part of Canton in granite, and at the northwestern extremity of New Milford in dolomite (537*b*).

Red Copper-Ore has only been found in very small quantity within the State, and always associated with native copper.

Yttro-Tantalite?—This very rare mineral is supposed to exist at Roaring brook in Glastenbury. It occurs in small crystalline grains, disseminated through a flesh-red granite (591) which contains crystals of green beryl. Unless this mineral belong to the present species, it will probably prove new. Its lustre is between resinous and metallic. Its color is iron-black, and its specific gravity is between 4·9 and 5·0. Alone before the blowpipe, it is unalterable; but with carbonate of soda, it slowly dissolves with effervescence, and when cold assumes a delicate sky-blue color.

Genus 3. *Iron-Ore.*

Magnetic Iron is an ore like iron-pyrites, widely diffused through the State, in a great variety of rocks; although rich deposits of it are less frequent than in many other regions of similar extent. It exists in beds at the following places: Buck's mountain, southeast part of Sharon, half a mile from the Housatonic (538*b*); in the southeast part of Reading near Sugar-hollow turnpike (544); in the northeast part of Winchester (542), and on Brown's mountain, New Preston (542*b*). It is found also in grains and octahedral crystals in a talcose mica-slate on Mount Riga in Salisbury (539*b*), and also in a small bed situated near the Massachusetts line in the same vicinity. Thin seams or beds of this species are found in Newtown associated with quartz in gneiss (643). Magnetic iron is found in granite, in

the condition of octahedral crystals and large granular individuals, in Hadlyme at Selden's point (541*b*). It is also common in North Madison near Col. BENTON'S, and at Haddam one mile north of the meeting-house (537*y*). The red feldspar-granite of Stonington (540*b*) and Groton, likewise abounds in small crystals and grains of this ore; and magnetic iron-sand is of frequent occurrence along the sea-coast of the State, from Milford to Stonington.

Chrome-Ore is found in small quantity in the green-marble range, closely blended with magnetic-iron.

Crichtonite occurs engaged in quartz in rolled masses (544*b*) among the diluvium of South Britain, and was undoubtedly derived from the contiguous mica-slate of Roxbury.

Specular-Iron is almost unknown in the State; traces of it only, existing in the copper-rock of Manchester (546), and in diluvial blocks of porphyritic gneiss at Killingly (545).

Limonite.—A remarkable region for this ore has long been known in the towns of Salisbury, Sharon and Kent, where it forms beds either in mica-slate, micaceous gneiss or quartz-rock.* The brown

* The origin of limonite in these rocks may be attributed to the decomposition of the sulphuret of iron and other ferruginous minerals with which they are known to abound. It is obvious also, that in a majority of instances, this change took place in the original repositories of these minerals; since no perceptible derangement is discoverable in the layers of the ore-bed, or want of conformity in them, to the adjacent rock. The Kent ore-bed is the only apparent exception to this remark. It is situated in a chasm running nearly north and south, between soft decomposed gneiss ("gray fuller's earth,") dipping 60 or 70° east on the one side, and micaceous quartz-rock on the other, dipping 80° west. The ore-bed consequently has the shape of a wedge. It is not however without order in the arrangement of its materials, for a description of which see p. 20 of the Economical Report. Attributing to it the origin here suggested, it would appear not improbable perhaps, that previous to the decomposition of the pyrites, the strata were all coincident and in the position of C and F (see diagram on p. 20), and that in consequence of the change, the strata D were broken and tilted over on to the edges of C. The quantity of limonite in the bed must constantly be receiving important contributions from the crumbling down of the ferruginous strata D. It would not perhaps be an extravagant hypothesis to assign the origin of the limonite here wholly to this source, without the supposition that any considerable beds of iron-pyrites originally existed in place of the ore-bed; for the overlying pyritous strata have a thickness of ten or twelve yards, and are favorably exposed for decomposition, both on account of access to the air and contiguity to moisture,—the surface in the rear of the bed at E, being wet and swampy. The escape of the limonite, on being washed into the bed, is prevented by the clayey nature of the decomposed gneiss A, whose inclination towards C also, would serve to

fibrous, ligniform variety (547, 548) and the ochraceous varieties (549, 553) constitute the prevailing kinds at the ore-hill and Davis' bed in Salisbury, as well as at the Indian ore-bed. A singular variety of micaceous, earthy limonite (551*b*) is found at Davis' ore-bed. The same place affords an impalpably compact, yellowish brown variety, called by the workmen "bees-wax ore." A compact heavy ore is found in the north part of Salisbury at the beds of CHAPIN & SCOVIL (552). The ore from Kent also is more compact and heavy than the average-ores of Salisbury and Sharon, in which respect, it resembles the ore found in the south part of Cornwall and at Washington. At this last place, it is contained in dolomite. Several varieties of bog iron-ore occur in the eastern part of the State. One, possessed of a vesicular sub-mamillary structure, is found in considerable quantity in Colchester (554.) The granular variety (553*b*), called "shot-ore," is found in Thompson and Woodstock. At the latter place a pumice-like ore occurs, much blended up with silica (556) which is probably derived from the feldspar of the rock that afforded the pyrites from whence the ore originated.

Genus 4. *Baryte-Ore.*

Wolfram.—This species, rendered the more interesting because of its being the frequent concomitant of tin-ore, is found in consid-

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accumulate it in the wedge-shaped bed B. It is noticeable moreover, that the largest vein of ore (the anvil-ledge) is that nearest to the eastern side, C, of the bed, and directly beneath the basseting edges D. It abounds in a coarse iron-breccia, made up of limonite and quartzy fragments of the strata D.

In evidence of an analogous origin to the other deposits of this ore, it may be remarked, that the micaceous and quartz-rocks of Salisbury, Sharon and Kent, are frequently found to be rich in iron-pyrites. The garnet and staurotide also of the mica-slate is often present in such proportion as to impart an highly ferruginous character to the rock. What the circumstances are which have induced decomposition in some places and left these minerals undecomposed in others, it is at present perhaps impossible to designate; though from the low level of the ore-beds and their contiguity to water, it is probable that this is an important agent in effecting the change under consideration.

The presence of zinc, lead and manganese in the ore-bed, as is proved by the formation of cadmia in the chimneys of the iron-furnaces, is well accounted for also on this supposition; since it is well known that iron-pyrites is rarely unattended by blende, galena and spathic-iron. The lights too, which are sometimes seen during the night in these regions, and which have repeatedly led to the discovery of ore-beds, can in no way be more satisfactorily explained, than by referring them to the chemical changes which must be connected with such a process.

erable quantity at Lane's mine in Monroe. It exists in an extensive bed of quartz, and is attended by tungsten, blende, galena, native bismuth, iron-pyrites, &c. It occurs both in large cleavable individuals and in porous masses, having an impalpable texture (557). The latter are often cast in the moulds of large crystals of tungsten, whose octahedral figure is precisely copied. The same mineral occurs under very similar circumstances in a vein of quartz at Trumbull, near the topaz-vein.

Columbite.—This interesting species, discovered in the eastern part of the State by one of the first governors of Connecticut, still continues to be found with us in unusual quantity and perfection. The most remarkable samples (559) have been developed of late in quarrying the china-stone at Middletown, some of which are distinguished for the finish of their crystals (see fig. 498 of my Mineralogy). They vary in size from a few lines in diameter to several inches in length; and one crystal has been found weighing fourteen pounds. The same granite range still farther north near the river, has also afforded crystals; and Columbite has long been known to exist in the chrysoberyl-vein at Haddam, where it presents itself both massive and in small slender prisms (558).

Pitchblende is another rare species developed in small quantity by the china-stone quarry at Middletown, where it is found massive and impalpable in composition, though often bounded by faces which belong to the octahedral crystallization of blende (see figure 67, my Mineralogy,) of whose crystals it is pseudomorphous (560).

Genus 5. *Manganese-Ore.*

Pyrolusite forms thin, pulverulent coatings on the limonite of Kent and Salisbury.

Genus 6. *Lusine-Ore.*

Tungstic Ochre attends the wolfram and tungsten of Monroe and Trumbull, in the form of a delicate straw colored powder (561).

Yellow Uranium Ochre, in the condition of a pulverulent straw, or citron, yellow color, occasionally accompanies the columbite and pitchblende of Middletown (562).

Green Uranium Ochre.—This substance was for the first time observed as a natural production in the china-stone quarry of Mid-

dletown. It occurs occupying small cavities, mostly situated in pitch-blende. Its texture is earthy, and its color dark green. It is free from the oxides of other metals, being a pure protoxide of uranium, with the exception of eight per cent. of earthy matter.

Melaconite.—This species in the form of a black pulverulent coating, occurs in very limited quantity along with other ores of copper, at the Bristol mine (562*b*).

Order IX. Metal.

Genus 1. *Malacone-Metal.*

Native Bismuth is found massive, disseminated through quartz (563) in Lane's mine at Monroe, accompanied by galena, blende and iron-pyrites.

Native Copper has frequently been met with in the secondary region of the State, both in diluvium and attached to greenstone trap. A mass was formerly found near New Haven, weighing ninety pounds, and one in Wallingford, half a mile west of the Hartford turnpike, weighing six pounds. It has been discovered on Mount Carmel penetrating trap, and in Bristol and Farmington under similar circumstances. Minute arborescences of this metal are found with yellow copper-pyrites at Lambert's mine in Orange, near Milford.

Genus 2. *Sclerone-Metal.*

Native Iron.—One of the best authenticated localities of this extraordinary substance is in Canaan. A mass, highly crystallized in its texture and interlaminated with plumbago, was detached from a rock on the Canaan mountain by Mr. Burrall. All attempts however, to re-discover the ore have proved ineffectual.

Order X. Pyrites.

Genus 1. *Eruthleucone-Pyrites.*

Copper-Nickel accompanies the smaltine of Chatham, with which ore it is intimately blended. It is massive, nearly impalpable in composition and of a red color (564).

Mispickel appears to be abundant in Derby, at a place called the silver-mine, where an adit was formerly carried for some distance

into the side of a hill, and a shaft sunk also in the immediate vicinity. It is generally massive and associated with quartz (566). It rarely contains galena and blende (565). Other localities are Quaker's Farms in Southbury (566*b*), and the Wilton lead-mine.

Smaltine.—A bed of this ore, associated with copper-nickel, galena and blende, is embraced in mica-slate at Chatham (567). It is found massive in small granular individuals of a tin-white color.

Genus 2. *Chlorone-Pyrites.*

Iron-Pyrites.—This species is too generally diffused to permit the enumeration of its localities, except in a few instances. Crystallized varieties are found in the chlorite-slate of Orange and Milford (570), in quartzy mica-slate in Stafford (571) and in the flagging-stone quarries at Haddam. Massive varieties abound in the pyritous gneiss of Colchester, Ashford, Tolland, Stafford and Union, and in several other towns of that part of the State. It likewise attends the magnetic iron-pyrites at New Fairfield and Trumbull.

Yellow Copper-Pyrites.—The most important localities of this species are, Trumbull (572), where it occurs at one place with magnetic iron-pyrites, fluor and topaz (574), and at another near by, with galena and iron pyrites; at Orange (Lambert's mine), where it is accompanied by iron-pyrites and rarely by native copper (574*y*); Litchfield (Mount Tom), with magnetic iron-pyrites; copper-mine at Bristol (572*b*); Southbury, near line of Roxbury (573*r*), in a loose mass; and in traces, in the towns of Killingly, Brooklyn, Chaplin and Vernon.

White Iron-Pyrites.—Fibrous varieties of this species are occasionally found in the mica-slate, and often aid in giving rise by decomposition to iron-alum. It occurs particularly at Haddam, in the quarry on the east side of the river, where it is associated with anthophyllite and mica.

Genus 3. *Bronze-Pyrites.*

Magnetic Iron-Pyrites.—The massive, cleavable variety of this species found at Trumbull, along with fluor, topaz and yellow copper-pyrites, is the most interesting variety found in the State (574). The common, massive kind is abundant on Mount Tom, in Litchfield, disseminated through a bed of sienite (573), sometimes accom-

panied by yellow copper-pyrites. It is also frequent in the mica-slate of Salisbury (574*b*) and its vicinity. A bronze-colored variety occurs at an excavation made in Brookfield for copper-ore (576). It is abundant also in New Fairfield, forming the ore principally, at Kellogg's copperas-mine (575).

Variegated Copper.—This is the chief ore at the Bristol copper-mine, where it occurs massive in granite-beds, contained in micaceous gneiss (578*r*, 577*b*). Small quantities of this species occur in seams of quartz, attended by yellow copper-pyrites and malachite at Rocky hill, Hartford (577), at the copper-mine in Manchester, and at the Higley copper-mine in Granby.

Order XI. Glance.

Genus 1. *Copper-Glance.*

Vitreous Copper.—This is the species which occurs at the copper-mines of Cheshire, Granby and Wolcottville. At Bellamy's mine in Cheshire, it is both massive and crystallized. The crystals have the form represented by figs. 461 and 462 of my Mineralogy. It is usually disseminated through sandstone-conglomerate, and is often attended by green malachite, calcareous spar and heavy spar (578, 578*b*, 579). It is likewise crystallized at Wolcottville.

Genus 2. *Polypoione-Glance.*

Galena.—This ore is found with blende at the Middletown lead-mine (582), at the Brookfield lead-mine (580), the lead-mine in Wilton (582), at Kensington in Berlin (581), at East Haven near the light-house in granite and in trap, as well as at Monroe and Trumbull.

Molybdenite is found in the Haddam flagging-stone quarries in broad flakes, between the layers of the gneiss, and in a bed of quartz at Pettipaug in Saybrook (587).

Bismuthine.—A few slender crystals of this species have been detected at Haddam, in the chrysoberyl-vein.

Order XII. Blende.

Genus 1. *Sclerone-Blende.*

Blende is found at the same places with galena. At Brookfield, it has a yellowish green color, and is semi-transparent (584*b*, 584),

at Berlin a pale yellow color (581), at Roxbury a brownish black color (585*y*) and at Lane's mine, Monroe (586), and at the cobalt-mine, a black color.

CLASS III.

Order I. Resin.

Genus 2. Mineral-Resin.

Bitumen, in dolomite-seams, contained in brown shale, occurs at Berlin (588); and in limestone at South Britain, Southington, Durham and Middlefield.

Order II. Coal.

Genus 1. Mineral-Coal.

Anthracite.—This species has only been found occupying small amygdaloidal cavities in trap, at West Hartford (311).

DESCRIPTIVE CATALOGUE

OF THE

SAMPLES COLLECTED FOR THE ILLUSTRATION OF THE GEOLOGY AND MINERALOGY OF THE STATE.

Part I. Geological Collection.

1 Gneissoid granite. Feldspar reddish white. East Haven.

2 Gneissoid granite. Feldspar reddish white. Partially decomposed. East Haven, near the light-house.

2*b** Gneissoid granite. Feldspar reddish white. Branford, from a quarry in the high-way.

3 Granite. Large grained. Feldspar white. Huntington, south part of the town.

4 Granite. Large grained. Albitic. Texture loose. Between Bethlehem and Watertown, on Nonnewog river.

4*b* Granite. Large grained. Albitic. Plymouth, near Hoadley's factory.

5 Granite. Large grained. Albitic, (pseudomorphous granite.) Wilton, Sugar-hollow turnpike.

6 Granite. Large grained. Contains both feldspar and albite, (pseudomorphous.) Watertown, one mile east of the centre.

7 Granite. Large grained. Albitic, (pseudomorphous.) Watertown, western border.

7*b* Granite. Large grained. Albitic, (pseudomorphous.) Plymouth, Hoadley's factory.

8 Granite. Large grained. Contains feldspar and albite. This rock forms irregular veins and nests in variety No. 40, Greenwich, U. S. quarry.

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* The letter *b* refers to the *blue* color of the ticket on the specimen. The letters *g*, *r* and *y*, are also employed in this catalogue as abbreviations for *green*, *red* and *yellow*.

8*b* Granite. Large grained. Cleavages of this rock striated and smooth. It forms powerful veins in gneiss. Middletown, Maromus.

9 Granite. Large grained. Albitic, (pseudomorphous.) Greenwich, southwest corner.

9*b* Granite. Large grained. Albitic, (pseudomorphous.) Canton, near the bridge, on road from New Hartford.

10 Granite. Talcy, albitic, (protogine.) Haddam, chrysoberyl-vein, near the meeting-house.

11 Granite. Ingredients feldspar, quartz, scapolite, chabasie and mica. Stonington, quarry near Paucatuck.

11*b* Granite. Feldspar purplish red. Stonington, one mile from termination of rail-way.

12 Granite. Large grained. Albitic. Contains apatite. Plymouth.

13 Graphic granite. Watertown, associated with No. 7.

13*b* Granite. Feldspar deep red. Torrington, Still-river-turnpike.

14*b* Granite. Feldspar deep red. Large grained. Contains magnetic iron. Torrington, three miles north of Wolcottville.

15*b* Granite. Feldspar deep red. Large grained. Stonington, one mile from termination of rail-way.

14 Granite. Ingredients feldspar and quartz. Resembles a pitchstone porphyry. Branford, occurs near a hill of trap.

15 Granite. Much traversed by quartz-veins and druses; brecciated in some spots, as if the seggregation had been interrupted by a mechanical deposition. Branford, occurs along with 14.

16 Granite. Quartz blue. Has a pitchstone-fracture. North Guilford, Essex turnpike.

16*b* Graphic granite. Haddam, quarry east side of Conn. river.

17 Granite. Ingredients, feldspar and quartz, intimately blended. Bethany, southeast corner. Forms thin beds in argillite.

18 Granite. Imperfectly shistose. Woodbridge, Litchfield turnpike. Occurs in argillite.

19 Granite. The feldspar predominating. Woodbridge, Litchfield turnpike.

20 Granite. Feldspathic. Greenwich, Miannus river, forms veins in gneiss.

21 Granite. Feldspathic. Fine porphyritic. Woodbridge, near the line of Bethany.

22 Granite. Feldspathic. Fine porphyritic. A weathered surface. Woodbridge, near the line of Bethany.

23 Granite. Ingredients, albite, feldspar and quartz. Lyme.

24 Granite. Fine grained, red. Contains albite. North Stamford, near the centre.

25 Gneissoid granite. Contains both feldspar and albite. New Milford, Candle mountain.

26 Gneissoid granite. Albitic. Mansfield, near the line of Chaplin.

27 Gneissoid granite. Albitic. Micaceous. Mansfield, near the line of Chaplin.

28 Gneissoid granite. Albitic. Fine grained. Bolton, forms narrow veins in mica-slate.

29 Feldspar granite. Eurite. Contains garnet. Norwalk, three quarters of a mile southwest of village.

30 Feldspar granite. Red. Darien.

31 Feldspar granite. Eurite. Semi-vitrified, near junction of trap-dyke. Derby.

32 Feldspar granite. Eurite. Griswold.

33 Feldspar granite. Fine granular. Texture loose. Canaan, highway near the post-office.

34 Feldspar granite. Eurite. Voluntown.

35 Feldspar granite. Feldspar stained by carbonate of copper. Bolton.

35*b* Quartzy granite. Fine grained, bluish-gray. Danbury.

36 Granite. Albitic. Fine grained. North Madison, near Col. Benton's.

37 Gneissoid granite. Albitic. Cornwall.

38 Gneissoid granite. Albitic. Stained from decomposition of iron-pyrites. Warren.

39 Gneissoid granite. Albitic. Weston, North Fairfield.

40 Gneissoid granite. Fine grained. Greenwich, U. S. quarry.

41 Gneissoid granite. Albitic. Greenwich, one mile northwest of Horse-neck meeting-house.

42 Granite. Contains both feldspar and albite, with occasional crystals of iron-pyrites. Texture close. Waterford, Millstone Point quarry.

42*b* Granite. Contains both feldspar and granite. Fine grained. Stonington, near Paucatuck.

43 Gneissoid granite. Albitic. Fine grained. Bridgeport, Thatchersville.

43*b* Granite. Contains both feldspar and albite. Fine grained, bluish gray. Portersville, north of bridge.

44*b* Granite. Feldspathic. Fine grained, reddish white. Stonington, Upper Mystic.

45*b* Granite. Feldspathic, fine grained reddish white. Exhibits junction of, with albitic gneiss. Stonington, Upper Mystic.

46*b* Granite. Contains feldspar and albite. Reddish white. Mica in part replaced by magnetic iron. Stonington, near railway, one mile from its termination.

47*b* Granite. Feldspathic, red. Stonington, near rail-way, one mile from its termination.

48*b* Granite. Contains feldspar and albite. Reddish gray. Very fine grained. Westerly, R. I.

49*b* Granite. Contains feldspar and albite. Includes crystals of iron-pyrites. Westerly, R. I.

50*b* Granite. Albitic. White. Westerly, R. I.

51*b* Granite. Albitic. White. Plymouth.

52*b* Granite. Albitic. Grayish white. Hebron, one mile south of village.

53*b* Gneissoid granite. Grayish white. Contains small crystals of garnet. Bozrah, five miles from Norwich landing.

44 Gneissoid granite. Fine grained, nearly white. Goshen, New Canada village.

45 Granite. Feldspathic, red. Fine grained. Contains albite. Groton, Upper Mystic.

46 Granite. Albitic. Dark gray, contains garnet. Derby, mispickel-mine.

47 Gneissoid granite. Similar to 40.

48 Granite. Similar to 46. Woodstock.

49 Porphyritic gneiss. Veined with quartz and calcareous spar. Contains specular iron, yellow copper-pyrites and green malachite. Manchester.

50 Gneissoid granite. Albitic, fine grained. Similar to 43. Thompson, northwest corner.

51 Gneissoid granite. Porphyritic, greenish gray. Glastenbury, Roaring brook.

52 Gneissoid granite. Porphyritic. Contains epidote. Brooklyn, road to Killingly.

53 Porphyritic gneiss. Feldspar red. Glastenbury. Roaring brook.

54 Porphyritic gneiss. Feldspar red. Killingly.

54*b* Porphyritic gneiss. Albitic. Litchfield, Bradleysville.

55 Porphyritic gneiss. Feldspathic. Derby.

55*b* Porphyritic gneiss. Feldspathic. Large grained. Woodstock, eastern border.

56 Porphyritic gneiss. Feldspathic. Small grained. Woodbury.

56*b* Gneissoid granite. Albitic. Haddam, quarry east side of Connecticut river.

57*b* Gneissoid granite. Albitic. Texture loose. Waterbury, two miles north of village.

58*b* Gneissoid granite. Albitic. Derby, Steele's quarry, east bank of Housatonic river.

59*b* Gneissoid granite. Albitic. Texture close. East Haddam, bank of Connecticut river.

60*b* Gneissoid granite. Hornblendic, with epidote. Thompson, one mile east of village.

57 Gneissoid granite. Albitic, with shining black mica. Greenwich, Miannus.

58 Gneiss. Micaceous. Greenwich, northwest of Horse-neck.

59 Gneiss. Micaceous. Weathered. Greenwich, northwest of Horse-neck.

60 Granitic gneiss. Feldspathic, sub-porphyritic. Contains epidote. Glastenbury, Roaring brook.

61 Gneissoid granite. Feldspathic, sub-porphyritic. Contains epidote. Chatham.

62 Gneissoid granite. Feldspathic, sub-porphyritic. Contains epidote. Glastenbury, Roaring brook.

63 Gneissoid granite. Feldspathic, sub-porphyritic. Eastbury.

64 Gneissoid granite. Similar to 2. East Haven.

65*b* Gneissoid granite. Feldspathic, red, large grained. Bethel.

65*b* Gneissoid granite. Feldspathic, white, large grained. Contains epidote. Thompson, two miles east of village.

66*b* Gneissoid granite. Feldspathic, red, large grained. Norwich, two miles north of landing.

67*b* Granitic gneiss. Albitic. Mica, shining black. Contains iron-pyrites. Madison.

66 Gneissoid granite. Feldspathic, reddish white. Thompson, near New Boston.

67 Gneissoid granite. Feldspathic, red. Stanwich.

68 Gneissoid granite. Contains feldspar and albite. Mica white. Stanwich.

69 Gneissoid granite. Contains feldspar and albite. Mica white. Norwich, near the centre.

69*b* Gneissoid granite. Feldspathic, reddish; mica in tortuous layers. Preston, Capt. Stoddard's quarry.

70*b* Feldspar granite (eurite). Contains garnet. Hampton, three miles northwest of meeting-house.

70 Gneissoid granite. Feldspathic. Black mica in small patches. Killingly, North Society.

71 Granite. Albitic. White, with small patches of black mica. Chatham, Great hill.

71*b* do. do. do. do.

72 Granitic gneiss. Albitic. Shistose. Somers.

73 Granitic gneiss. Albitic. Shistose. Thompson, near New Boston.

73*b* Granitic gneiss. Albitic, with feldspar; shistose; mica in broad patches. Thompson.

74 Plumbaginous gneiss. Cornwall.

75 Granitic gneiss. Albitic. Shistose. North Stamford, High ridge.

75*b* Gneissoid granite. Contains both feldspar and albite. Edges of layers strait. Thompson, east border.

76 Gneiss. Micaceous, pyritiferous. Union.

77 Granitic gneiss. Albitic. Micaceous. Greenwich. Miannus.

78 Granitic gneiss. Albitic. Micaceous. Horse-neck.

78*b* Granitic gneiss. Albitic. Micaceous. Between Stafford and Union.

79 Granitic gneiss. Albitic. Micaceous. Woodbury.

80 Gneiss. Contains garnet. Warren.

81 Granitic gneiss. Albitic. Contains feldspar. Derby, west side of Housatonic bridge.

81*b* Granitic gneiss. Albitic. Texture loose. Haddam, Higganum.

82*b* Granitic gneiss. Albitic. Middletown, Maromus.

82 Granitic gneiss. Albitic. Fairfield, Burr's quarry.

83 Granitic gneiss. Albitic. Cleavages stained with oxide of iron. Fairfield, Burr's quarry.

84 Granitic gneiss. Albitic. Newtown, Judson's quarry.

85 Granitic gneiss. Feldspathic. Reading, Top-stone hill.

86 do do do.

86*b* Granitic gneiss. Feldspathic. Reddish gray. Stratification even. Plainfield quarry, eastern part of town.

87 Granitic gneiss. Albitic. Mica black. Contains iron-pyrites, epidote, sphene and garnet. Preston, Long Society.

88 Granitic gneiss. Feldspathic. North Stamford, High ridge.

88*b* Granitic gneiss. Feldspathic, with garnet and black mica. Norwich.

89 Granitic gneiss. Albitic. Mica white. Roxbury, Mine hill.

89*b* Granitic gneiss. Albitic. Close grained. Lebanon, northwest corner.

90*b* do. do do. do.

91*b* Granitic gneiss. Feldspathic. Close grained. Lebanon, northwest corner.

92*b* Granitic gneiss. Feldspathic, with albite, close grained. Lebanon, northwest corner.

90 Gneiss. Albitic, thin and fissile. Milford, Washington bridge.

91 Gneiss. Albitic. Windham, Willimantic.

92 Gneiss. Albitic, thin, talcy. Newtown, half mile northeast of Judson's quarry.

93 Gneiss. Albitic, with garnet. Bolton, embraced in mica-slate.

94*b* Gneiss. Albitic, with garnet. Vernon, embraced in mica-slate.

94 Gneiss. Quartzy, fine grained. Texture close. Windham, north part of Scotland.

94*b* Gneiss. Albitic. Haddam, Allen-vein.

95 Gneiss. Contains weathered crystals of kyanite? Roxbury.

95*b* Gneiss. Albitic, with quartz in excess. Plymouth.

96 Gneiss. Pyritiferous, decomposing. Kent, ore-bed.

96*b* Gneiss. Pyritiferous, decomposing. Colchester, S. W. corner.

97*b* Gneiss. Pyritiferous, decomposed. "Fuller's earth." Kent, ore-bed.

98*b* Gneiss. Pyritiferous, decomposed. "Shell." Kent, ore-bed.

97 Granite. Feldspathic. Shows its junction with gneiss. Bridgeport, Thatchersville.

98 Granite. Feldspathic. Shows its junction with gneiss. Guilford.

99 Granite. Feldspathic. Shows its junction with gneiss. Greenwich, Miannus.

100 Granite. Feldspathic, with Iron-Pyrites. Shows its junction with gneiss. Killingly, Eastford.

101 Granite. Feldspathic. Shows its junction with gneiss. Greenwich, W. of Horse-neck.

102 Quartz seam, included in granitic gneiss. Willimantic.

103 Granite. A tortuous layer in gneiss. Norwalk, 1 m. E. of village.

104 Granite. A tortuous layer in mica-slate. Bolton.

105 Gneiss. Stained with green malachite. Bristol, copper-mine.

106 Granite. Shows junction of large and fine-grained varieties. Greenwich, U. S. quarry.

107 Chloritic granite. Black. Ingredients, feldspar, mica and talc. Danbury, Bethel.

108 Chloritic granite. Black. Ingredients, feldspar, mica and talc. Lebanon.

109 Sienite. Litchfield, Mount Tom.

110 Hornblende rock. Weston, near line of Reading.

111 Sienite. Litchfield, west part of town.

112 Sienite. Lebanon.

112*b* Sienite. Litchfield, Bradleysville.

113*b* Hornblende rock. Compact, (diabase). Contains distinct imbedded crystals of hornblende. Guilford, from a boulder.

114 Porphyry. Black. North Stonington, near Lantern hill.

115 Sienite passing into compact trap, (diabase). Litchfield, Mount Tom.

116 Sienite, or hornblendic gneiss. Ellington, near line of Somers.

116*b* Porphyritic sienite. Bridgewater, near the Housatonic.

117 Hornblendic gneiss. Ellington.

118 do. do. do.

119 Hornblende-slate. New Milford, falls of the Housatonic.
120 Hornblende-slate. Woodbury.
121 Hornblende-slate, with ferruginous stains. Woodbury.
122 Hornblende-slate. Torringford.
123 Hornblende-slate. Contains acicular crystals of hornblende. Torringford.
124 Gneiss. Quartzy. Contains bucholzite, white talc and magnetic iron. Norwich, falls of the Yantic.
125 Granitic gneiss. Contains ovoidal patches of garnet. Reading.
126 Green chloritic granite, purplish. North Stonington, near Lantern-hill.
127 do. do. do. do.
127*b* Green chloritic granite, purplish. Stonington point, from a diluvial block.
128 Hornblende-rock; garnetiferous, with pyroxene and iron-pyrites. Greenfield, from a loose mass.
129 Epidotic gneiss. Contains iron-pyrites and chlorite. Plainfield.
130 Hornblendic rock. Contains rounded grains of quartz. Stafford.
131 Hornblendic rock. Contains rounded grains of quartz; weathered. Stafford.
132 Mica-slate. Greenfield hill.
133 Mica-slate. Contains garnet. Saugatuc.
133*b* Mica-slate. Contains albite and kyanite. Plymouth, east end of village.
134 Mica-slate. Contains garnet. Franklin, northwest corner.
135 Mica-slate. Windham, Scotland.
135*b* Mica-slate. Killingly, east side of Flag-stone hill.
136 Mica-slate. Derby, from the side of a trap-dyke.
137 Mica-slate. Litchfield, near Great Lake.
138 Mica-slate. Contains imbedded granules of quartz. Litchfield.
139 Mica-slate. Litchfield.
140 Mica-slate. Light gray. Litchfield.
141 Mica-slate. Contains crystals of mica imbedded obliquely to the stratification. Orange, one mile west of meeting-house.
141*b* Mica-slate. Vernon, flag-stone quarry.

142 Mica-slate. Similar to 141. Berlin, north of Worthington village, from a large boulder.
143 Mica-slate. Contains garnet. Stafford.
144 Mica-slate. Calcareous. Sharon, south of Indian Pond.
145 do. do. do.
146 Mica-slate. Stratification very undulatory. Roxbury.
146*y* Mica-slate. Calcareous. Vernon.
147 Mica-slate. Contains garnet. Surface wavy. Vernon.
148 Mica-slate. Shows a double cleavage. North Orange.
148*b* Mica-slate. Shows a double cleavage. Surface wavy and fibrous. Killingly, northeast of Westfield.
149 Mica-slate. Contains curved, lenticular masses of quartz. Greenfield.
150 Mica-slate. Contains curved, lenticular masses of quartz. Approaches in character to argillite. Woodbridge.
151 Mica-slate. Plumbaginous. Approaches argillite. Newtown.
152 Mica-slate. Plumbaginous. Approaches argillite. Middletown, lead-mine.
153 Mica-slate. Approaches argillite. Orange.
154 Argillite. Chloritic. Woodbridge, Sperry's mills.
155 do. do. do.
156 do. do. do.
157 Argillite. North Orange.
158 Argillite. Shows a striated cleavage. North Orange.
159 Argillite. Shows a striated cleavage. Grayish black. North Orange.
160 Argillite. Greenish gray. Woodbridge.
161 Mica-slate. Woodbridge.
162 Argillite. Stratification thin, fissile. Woodbridge.
163 Argillite. Approaches mica-slate. Orange, near the meeting-house.
164 Argillite. Much contorted. Occurs with 17. Bethany.
165 Flinty slate. Occurs with 21. Bethany.
166 Argillite. Stratification very thin. Woodbridge.
167 Argillaceous limestone. Woodbridge, Litchfield turnpike.
168 Argillaceous limestone. Contains iron-pyrites. Amity.
169 Argillaceous limestone. Having cross-seams filled with calcareous spar. Amity.

170 Quartzy mica-slate. North Woodstock.
171 Quartzy mica-slate. White. Stafford.
172 Quartzy mica-slate. White. Killingly.
173 do. do. do.
174 Quartzy mica-slate. White. Franklin.
175 Quartzy mica-slate. White. Voluntown, in diluvium.
176 Quartzy mica-slate. White. Roxbury.
177 Quartzy mica-slate. Brownish white. Killingly, Bolles and Tyler's quarry.
178 do. do. do.
179 Quartzy mica-slate. Grayish white. Killingly, Chesnut hill.
179*b* Quartzy mica-slate. Greenish white. Killingly, near Young's factory.
180*b* Quartz-rock. Kent.
181*b* Quartz-rock. Sharon.
180 Quartzy gneiss. Ferruginous. Kent, ore-bed.
181 Quartzy mica-slate. Woodbury, northwest part.
182 Quartzy mica-slate. Stafford.
183 Quartzy mica-slate. Epidotic. Killingly.
184 Quartzy mica-slate. Epidotic. Killingly, west part of Chesnut-hill.
185 Chlorite-slate. West Haven.
186 Chlorite-slate. Wavy. West Haven.
187 Chlorite-slate. Dark green. West Haven.
188 Chlorite-slate. Contains iron-pyrites. West Haven, Savin rock.
189 Chlorite-slate. Light green. West Haven, Savin rock.
190 Chlorite-slate. Shows a thick seam of quartz. West Haven.
191 Chlorite-slate. Presents a distinct cross-cleavage.
192 Chlorite-slate. Ingredients separate. West Haven.
193 Quartz, from a large vein in chlorite-slate. Orange, near Milford, Lambert's mine.
194 Chlorite-slate. With cleavages having a red ferruginous glaze. Milford, marble-quarry.
195 Chlorite-slate. Approaches talcose slate. Milford.
196 Chlorite-slate. Approaches talcose slate. Quartzy. Contains magnetic iron. Orange.
197 Chlorite-slate. Twelve feet from trap-dyke. New Haven, near line of Woodbridge.

198 Chloritic trap. West Haven.
199 Chloritic trap. Sub-shistose. West Haven.
200 Chloritic trap. Shows several cleavages. West Haven.
201 Chloritic trap. Porphyritic. Contains epidote. Orange.
202 Chloritic trap. Porphyritic. Contains epidote. West Haven, Allentown.
203 Chloritic trap. Contains serpentine and epidote. West Haven, Allentown.
204 Chloritic trap. Porphyritic. West Haven.
205 Chloritic trap. Orange, near Milford line.
206 Chloritic trap. Very compact. West Haven.
207 Hornblendic gneiss. North Milford, western part.
208 Chlorite-slate, altered by trap-dyke. New Haven, Humphreysville turnpike.
209 do. do. do. do.
210 do. do. do. do.
211 do. do. do. do.
212 Talcose slate. Wilton, northeast part of town.
213 Asbestus-rock. Wilton, northeast part of town.
214 Talcose slate. Dark green. Somers, soapstone-quarry.
215 Talcose slate. Dark green. Bristol, Bartholomew's factory.
216 Talcose slate. Hornblendic. Somers, soapstone-quarry.
217 Granular limestone. North Milford, west part.
218 Dolomite. North Stonington, near line of Preston, Geer's lime-kiln.
219 Granular limestone. Bolton, notch of Bolton mountain.
220 do. do. do.
220*b* Granular limestone. Quartzy. Dark blue, veined with white. Sharon, Indian pond. From a boulder.
221 Dolomite. Washington, marble-quarry.
222 Granular limestone. Blue. Contains hornblende and pyroxene. North Milford.
223 Granular limestone. Blue. Contains hornblende and pyroxene. Orange.
224 Granular limestone. Gneissoid. North Canaan, half a mile west of the meeting house.
224*b* Granular limestone. Passing into mica-slate. Vernon.
225 Dolomite. Ridgefield, northwest corner.

226 Dolomite. Contains crystals of tremolite. Canaan.
227 Dolomite. Contains pyroxene. Canaan.
228 Dolomite. Contains boltonite. Danbury.
229 Green marble. (Ophio-calcite.) Milford.
230 Green marble. (Verd antique.) Milford.
231 Green marble. Milford, Boardman's quarry.
232 Yellow marble. New Haven.
233 do. do.
234 Topaz-rock. Ingredients, topaz, mica, fluor and talc.
235 Choritic trap. Torrington.
236 Serpentine. Contains hornblende and magnetic iron. Winchester, northeast corner.
237 Serpentine. Contains hornblende and mica. Greenwich, Horse-neck.
237*b* Serpentine. Litchfield, east part.
239 Sandstone-conglomerate. Coarse. North Guilford, Quinnipaug pond.
240 Sandstone-conglomerate. Fine, grayish white. North Branford, northwest of village.
241 Sandstone-conglomerate. Coarse, including a mass of white granite. East Windsor, Wapping quarry.
242 Marly sandstone. Fine grained, variegated. North Hamden, Tallman's mine.
242*b* Marly sandstone. Fine grained. Contains nodules of limestone. Unionville, quarry on Farmington river.
243 Sandstone-conglomerate. Composed of distinct pebbles. Chatham quarry.
243*b* Sandstone-conglomerate. Contains fragments of chlorite-slate. Hamden, quarry at west end of Mount Carmel.
244*b* Sandstone-conglomerate. Contains argillite. Hamden, quarry at west end of Mount Carmel.
245*b* Sandstone-conglomerate. Coarse. East Haven.
244 Sandstone-conglomerate. Fine, grayish white. Granby.
245 Red sandstone (freestone). Chatham quarry.
245*y* Red sandstone. Fine grained. Line of Farmington and Bristol.
246 Sandstone-conglomerate. Reddish white, with tinge of green. North Haven.

246*b* Sandstone-conglomerate. Reddish white and dull brick red (*bunter sandstein*). North Haven.

246*y* Sandstone-conglomerate. Reddish white, having cavities filled with green clay. North Haven.

247 Red sandstone. Fine grained. Deep red. East Windsor, Wapping quarry.

248 do. do. do. do.

249 Red sandstone. Fine grained. Slaty. North Branford, west foot of Toket range.

250 Variegated sandstone. Simsbury, near the meeting-house.

250*b* Red marl. Cheshire, one mile west of the meeting-house.

251 Sandstone-slate. White. Woodbridge, in blocks on eastern slope of argillite-range.

252 Sandstone-slate. Red. Simsbury, occurs with 250.

253 Sandstone-slate. Greenish gray. Simsbury.

253*b* Copper-slate (*kupferschiefer*) occurs with 254 and 255. Enfield falls.

254 Sandstone-slate. Fine grained, banded. Enfield falls.

255 Sandstone-slate. Fine grained, banded. Enfield falls.

256 Sandstone-slate. Fine grained. Hartford, Rocky hill.

257 Sandstone-conglomerate. Contiguous to trap-dyke. East Haven.

257*b* Red marl-slate. Wethersfield.

258 Sandstone-conglomerate. Contiguous to trap-dyke. Wallingford, Hartford turnpike.

259 Cupriferous sandstone-slate. Contains vegetable remains. Enfield falls.

259*b* Sandstone-slate. Contains vegetable remains. Durham.

260 Sandstone-conglomerate. Contiguous to trap. Shows smooth, striated cleavages. Branford.

260*b* Sandstone-slate. Red. Contains a fossil-stem. Middletown.

261*b* A fossil vegetable stem, in sandstone. Middletown.

262*b* Red sandstone, containing ovoidal, organic? bodies. Unionville, quarry in bed of Farmington river.

262 Sandstone-slate. North Guilford.

263 Sandstone-conglomerate. Altered by trap-dyke. East Haven.

263*b* Red sandstone. Similar to 262*b*. Unionville.

264 Sandstone-conglomerate. Contiguous to trap. Wallingford. Northford.

265 Sandstone-marl, altered by trap. Wallingford. Northford.
266 do. do.
267 Sandstone-conglomerate, altered by trap. Trachytic. East Haven, northwest part.
268 Sandstone-slate, altered by trap. Hartford, Rocky Hill.
269 do. do.
270 Sandstone-porphyry. North Branford.
271 Sandstone-conglomerate. Cupriferous. Cheshire, Gaylord's mine.
272 do. do. do.
273 Clay, altered by trap. Granby. Higley mine.
274 Sandstone-slate, marly. Southington.
274*b* Sandstone-slate, marly. Durham.
275 Sandstone-slate, marly. Southington.
276*b* Sandstone-slate. Thin, micaceous. Durham.
276 Bituminous marl-slate. Southington.
277 Bituminous slate. Contains ichthyolites, belonging to the family of *Lepidoides*. Durham.
277*b* Bituminous slate. Wethersfield.
278 do. do.
278*b* Bituminous slate. Similar to 277. Durham.
279*b* do. do. do.
279 Bituminous slate. Windsor, coal-digging, west of Pequonnuc.
280 Brown shale. Berlin, south part of New Britain, Hart's mills.
281 Bituminous limestone. Southington. Merriman's quarry.
282 Bituminous shale. Southington. Moore's quarry.
283 Dendritic marl. do. do.
284 do. do. do.
285 Septaria. do. do.
286 Clayey marl. Durham, occurs with 277.
287 Marly limestone, divided by veins of red clay. Southbury, South Britain.
287*b* Aluminous marl. Durham.
288 Compact limestone (zechstein). Southbury, South Britain.
289 Compact limestone (zechstein). Contains ichthyolites. Southbury, South Britain.
289*y* Compact limestone (zechstein). A new species of fossil-fish. Southbury, South Britain. Presented by Mr. Tomlinson, Innkeeper, of Brookfield.

290 Bituminous limestone. Slaty. Southington, Moore's quarry.
291 do. do. do. do.
292 Bituminous limestone. Durham.
293 Bituminous limestone. Southington. Merriman's quarry.
294 Gray compact limestone. Southington. Moore's quarry.
295 Gray compact limestone. Southington, Moore's quarry.
296 Gray compact limestone (zechstein). Guilford, northeast of Northford, Elliot's quarry.
296*b* Gray compact limestone (stalagmitic). do. do.
297*b* Gray compact limestone. Bituminous. do. do.
297 Marly clay. Indurated. Wallingford, occurs with 264, 265, 266.
298 Greenstone-trap. A trihedral prism. North Branford, Toket range.
299 Greenstone-trap. A tetrahedral prism. North Branford, Toket range.
300 Greenstone-trap. From a dyke several rods wide. North Guilford, Essex turnpike.
300*b* Greenstone-trap. From a dyke several rods wide. Haddam, Higganum.
300*y* Greenstone-trap. From a boulder. Hebron, Andover, near meeting-house.
301 Greenstone-trap. From a dyke, cutting through chlorite-slate (197). Woodbridge.
302 Greenstone-trap. Feldspathic. Durham, near line of Guilford.
303 Greenstone-trap. Has a distinct cross-cleavage. Contains iron-pyrites. North Branford.
304 Greenstone-trap. Compact. Exhibits line of junction with micaceous gneiss. Derby.
305 Greenstone-trap. Compact. Exhibits line of junction with gneiss. Derby.
305*b* Greenstone-trap. Compact. Exhibits line of junction with gneiss. Haddam.
306 Greenstone-trap. Contains black serpentine, chlorite and limestone. East Haven, Black rock.
306*b* Greenstone-trap. Chloritic, with glazed, striated surfaces. Hartford, Rocky hill.
307 Greenstone-trap. In concentric balls. Decomposing. West Hartford.

308 Greenstone-trap. Contains agate. Cheshire, southeast corner.
309 do. do. do.
310 Greenstone-trap. Brecciated. East Haven, northeast corner.
311 Greenstone-trap. Amygdaloidal. Contains anthracite. West Hartford, with 307.
312 Greenstone-trap. Amygdaloidal. Southbury.
313 Greenstone-trap. Veined with heliotrope. Southbury.
314 Greenstone-trap. Argillaceous. North Branford, near line of East Haven.
315 Greenstone-trap. Argillaceous. Colored by green earth. Contains seams of white limestone. Southbury.
316 Greenstone-trap. Argillaceous and calcareous. Southbury.
316*b* Greenstone-trap. Amygdaloidal, with dolomite. Durham, two miles south of the meeting-house.
317*b* Greenstone-trap. Amygdaloidal, with dolomite. Decomposing. Durham, two miles south of the meeting-house.
318*b* do. do. do. do.
317 Greenstone-trap. Similar to 314. Surface covered by arragonite. North Branford.
318 Greenstone-trap. Intermingled with sandstone, clay and calcareous spar. Cupriferous. Simsbury, Higley mine.
319 Greenstone-trap. Forming a breccia with marly clay. Simsbury, Higley mine.
320 Quartz-vein in trap. Containing green and blue malachite, with anthracite. Hartford, Rocky hill.
321 Datholite-vein in trap. Hartford, Rocky hill.
322 Brecciated quartz. Cemented by limonite. Kent, ore-bed.
322*b* Brecciated quartz. Kent, south part.
323 Brecciated quartz. Thompson, northeast part.
323*b* Brecciated quartz. Cemented by limonite. Kent, south part.
324 Yellow jasper. Canaan, near New Canada, in diluvium.
325 Sand. Fine, white. Killingly, east of Eastfield.
326 Clay. Southbury.
327 Bog iron-ore. Colchester.
328 Bog iron-ore. Contains siliceous sinter. West Woodstock.
329 Ferruginous conglomerate. Orange, in diluvium.
330 Siliceous loam. Fine. Hebron, Andover parish.
330*b* Clay, stained by phosphate of iron. Manchester, copper-mine.

331 Sand. Fine, white. Middlebury. Quosipaug pond.

332 Sand. Consists of quartz, garnet and magnetic iron. East Haven, light-house.

Part II. Mineralogical Collection.

333*b* White Copperas (—— *Vitriol-Salt*). A mealy efflorescence on iron-pyrites and magnetic iron. Washington, New Preston.

333 Cube-ore (*Hexahedral Malachite-Haloide*). A green crust on mispickel. Derby.

334 Fluor (*Octahedral Fluor-Haloide*). Crystallized. Trumbull.

335 Fluor. Massive; purple. Trumbull.

336 Fluor. Massive; green. Trumbull.

337 Fluor. Massive; reddish white. Trumbull.

338 Fluor. Massive; purple. Variety chlorophane. Trumbull.

339 Fluor. Massive; purple. In granite. East Haven, light-house.

340 Apatite (*Rhombohedral Fluor-Haloide*). In slender, greenish white prisms. North Stonington, Paugatuck quarry.

340*y* Apatite. In pale greenish, transparent crystals. Haddam, Allen-vein.

340*g* Apatite. In yellowish green crystals. Plymouth, near Hoadley's factory.

340*r* Apatite. In pale bluish crystals. Winsted, one mile east of village.

340*b* Apatite. In pale bluish prisms. Waterbury two miles north of village.

341*y* Apatite. In pale bluish and reddish prisms. Middletown.

341 Arragonite (*Prismatic Lime-Haloide*). In white crystals, on micaceous gneiss. Vernon.

341*b* Arragonite. An incrustation on sandstone-conglomerate. East Haven.

342*b* Arragonite. In small white crystals, occupying cavities in sandstone-conglomerate. East Haven.

343*b* Arragonite. A coralloidal incrustation on red sandstone. East Windsor, Wapping.

344*b* Arragonite. In slender, transparent crystals, on copper-slate. Enfield falls.

342 Calcareous spar (*Rhombohedral Lime-Haloide*). Large grained. White. Derby, lime-kiln on the Housatonic.

343 Calcareous spar. Large grained. Blue. Derby, lime-kiln on the Housatonic.

344 Calcareous spar. White. North Guilford.

345 Calcareous spar. White. Watertown, Bidwell's quarry.

345*b* Calcareous spar. White. Brookfield, lead-mine.

347*b* Calcareous spar. Bluish white. Vernon.

347*y* Calcareous spar. White. Danbury, quarter of a mile west of meeting-house.

346 Calcareous spar. White. Curved lamellar; variety argentine. Trumbull.

347 Calcareous spar. White. From a vein in trap. Berlin.

348 Dolomite (*Macrotypous Lime-Haloide*). Crystallized and massive. Ridgefield, Mead's lime-kiln.

349 Dolomite. Massive. Ridgefield, one mile southwest of Mead's.

349*b* Dolomite. Massive. Kent, near Gaylord's bridge.

350 Dolomite. Massive. Occurs with 348.

350*b* Dolomite. Massive. Washington, northeast part.

351*b* Dolomite. Massive. Shistose. Washington, Allen's quarry.

351 Dolomite. Massive. Brookfield.

351*y* Dolomite. Massive. Reading, Hills' quarry.

353 Dolomite. Massive. Fine grained. Washington, Allen's quarry.

354 Dolomite. In crystals and massive. Variety pearl-spar. Occurs with fluor in brown shale. Berlin.

355 Dolomite. Massive. A vein in sandstone-slate. Berlin, Worthington.

356 Dolomite. Massive; decomposing. Berlin, Worthington.

356*b* Dolomite. Massive. A vein in gneiss. Norwich, two miles north of the landing.

357 Spathic iron (*Brachytipous Parachrose-Baryte*). Massive. Light yellowish brown. Roxbury.

358 Spathic iron. Massive. Dark reddish brown. Roxbury.

358*b* Triplite (*Prismatic Parachrose-Baryte*). Massive. Brownish black. Coated occasionally by pulverulent diallogite. Washington.

358*r* Calamine (*Rhombohedral Zinc-Baryte*). Pulverulent; white. Associated with blende and calcareous spar. Brookfield, lead-mine.

359 Tungsten (*Pyramidal Tungstic-Baryte*). Massive. Imbedded in quartz. Monroe, Lane's mine.

359*b* Edwardsite (*Hemi-prismatic Tungstic-Baryte*). In small reddish brown crystals. Associated with bucholzite in granite. Norwich, falls of the Yantic.

360 Heavy spar (*Prismatic Hal-Baryte*). In crystals and massive. Cheshire.

361 Heavy spar. In crystals and massive, with vitreous copper and green malachite. Cheshire.

361*b* Pyromorphite (*Pyromorphous Lead-Baryte*). Pulverulent. Yellowish green. Brookfield, lead-mine.

362 Green malachite (*Habroneme Copper-Baryte*). In fascicular aggregations of delicate fibres, with quartz and heavy spar. Cheshire.

362*b* Green malachite. Pulverulent with variegated copper. Bristol, copper-mine.

363 Green malachite. Pulverulent with vitreous copper. Granby, Newgate.

364 Green malachite. Pulverulent in gneiss. Bristol.

365 Green malachite. Pulverulent. Manchester.

366 Green malachite. Pulverulent on quartz. Orange, Derby turnpike.

367 Green malachite. Pulverulent on sandstone. North Hamden, Tallman's mine.

367*b* Uranite (*Pyramidal Euchlore-Mica*). In greenish yellow crystals and laminæ. Middletown, china-stone quarry.

368 Plumbago (*Rhombohedral Graphite-Mica*). In minute scales in limestone, with sphene and pyroxene. Vernon.

369 Plumbago. In broad laminæ, in quartz. Cornwall.

370 Plumbago. In columnar laminæ. Cornwall.

371 Plumbago. In small scales; disseminated through quartz and epidote. Bethany.

371*y* Plumbago. In small scales; disseminated though quartz. Danbury.

372 Talc (*Prismatic Talc-Mica*). In minute bluish green scales, (variety nacrite.) Ridgefield, Mead's lime-kiln.

372*y* Talc. In minute green scales, (variety chlorite.) Norwich.
373 Talc. Slaty; dark green. Somers.
373*y* Talc. Variety chlorite, containing black mica. Litchfield, east part.
374 Talc. Talcose slate, containing minute fibres of tremolite. Somers.
375 Talc. Chlorite. Newtown.
376 Talc. In fine scales. White; with topaz. Trumbull.
376*y* Talc. Compact; greenish gray, (French chalk.) Bristol.
377*b* Talc. Compact; greenish. Newtown.
377 Mica (*Rhombohedral Talc-Mica*). Crystallized. Implanted on quartz. Middletown, china-stone quarry.
378 Mica. In scales; white. In calcareous spar. Watertown.
379 Mica. Variety pinite. Haddam.
380 Serpentine (*Prismatic Atelene-Picrosmine*). Crystals imbedded in dolomite. Ridgefield, Mead's lime-kiln.
381 Serpentine. Compact. Precious serpentine. Milford, marble-quarry.
382 Picrolite (*Fibrous Atelene-Picrosmine*). In strait parallel fibres; green. Stratford.
382*b* Picrolite. In minute brownish fibres, with serpentine. New Haven, marble-quarry.
383 Picrolite. In long silky fibres (asbestus), associated with dolomite. New Haven, marble-quarry.
385 Kyanite (*Prismatic Disthene-Spar*). In crystals and massive; color blue. Bolton.
386 Kyanite. In crystals and massive; color blue. North Coventry.
387 Kyanite. Massive. Litchfield.
387*b* Kyanite. Massive. Plymouth.
388 Kyanite. Massive. Color grayish white. Chaplin.
389 Spodumene (*Prismatoidal Disthene-Spar*). In small laminæ, disseminated through granite. Brookfield.
390 Datholite (*Prismatic Dystome-Spar*). Crystallized, in trap. Southington.
391 Datholite. Massive; a vein in trap. Hartford, Rocky hill.
392 do. do. do.
393 Datholite. Crystallized and fibrous (*botryolite*). Southington.

394 Datholite. Massive. Southington.

395 Prehnite (*Axotomous Kouphone-Spar*). Fibrous, in reniform shapes. Woodbury.

396 Prehnite. In crystals, on chlorite-slate altered by trap. New Haven.

396*b* Laumonite (*Diatomous Kouphone-Spar*). Crystallized and massive. Litchfield, Bradleysville.

397*b* Mesotype (*Prismatic Kouphone-Spar*). In compact radiating fibres. Hadlyme.

398 Analcime (*Hexahedral Kouphone-Spar*). In crystals, on trap. East Haven.

399 Chabasie (*Rhombohedral Kouphone-Spar*). In crystals and massive; color wax-yellow. North Stonington, near Paugatuck.

399*b* Chabasie. In crystals and massive, with stilbite. Hadlyme.

400 Stilbite (*Prismatoidal Kouphone-Spar*). In crystals. East Haven.

401 Stilbite. In crystals. Bridgeport, Thatchersville.

401*b* Heulandite (*Hemi-prismatic Kouphone-Spar*). In crystals, with stilbite, epidote, scapolite and garnet. Hadlyme.

402*b* Feldspar (*Orthotomous Feldspar*). A large four-sided prism with rounded extremities. Litchfield, Bradleysville.

402 Feldspar. In small white crystals. Canterbury.

403*y* Feldspar. Massive; white; in a certain light, chatoyant. Woodstock, Muddy brook.

403 Feldspar. Massive; flesh-red. Greenwich, U. S. quarry.

403*b* Feldspar. Massive; gray. Altered by contact with trap. Haddam, Higganum.

404 Feldspar. Massive; flesh-red. Bridgeport, Thatchersville.

404*b* Feldspar. Massive; flesh-red. Chatoyant (*adularia*). Norwich, Falls of Yantic.

405*b* Feldspar. Massive; yellowish gray. Reading, near line of Danbury.

405 Feldspar. Massive; deep red. New Canaan, near meeting-house.

406*b* Feldspar. Massive; purplish gray. With chlorite. North Stonington.

406 Feldspar. Massive; flesh-red. Exhibits in a certain light the properties of the sun-stone. Lyme.

407 Feldspar. Massive; penetrated by irregular prisms of quartz. Lyme.

408 Feldspar. Massive; white. In large individuals. Greenwich.

409 Feldspar. Massive; bluish-white. In large individuals. Greenwich, southwest of Horse-neck village.

410*b* Feldspar. Massive; yellowish white. In large individuals. Middletown, china-stone quarry.

411 Feldspar. Massive; yellowish white. Intimately blended with albite. Middletown, china-stone quarry.

412 Feldspar. Massive; reddish white. Intimately blended with albite. Middletown, china-stone quarry.

413 Feldspar. Massive; greenish white. Stained by carbonate of copper. Bolton.

415 Feldspar. Massive; bluish white; fetid. Brookfield.

416*b* Feldspar. Massive; bluish white; fetid. Danbury, near Col. White's factory.

416 Feldspar. Massive; white. New Milford, Candle-wood mountain.

417 Feldspar. Massive; white, with albite. New Milford, Candle-wood mountain.

418 Feldspar. Massive; white, with albite; partially decomposed. New Milford, Candle-wood mountain.

419 Feldspar. Massive; white, with albite; wholly decomposed (kaolin). New Milford, Candle-wood mountain.

420 do. do. do.

421 do. do. do.

422 Feldspar. Yellowish white, mingled with mica; partially decomposed. New Milford.

423 Feldspar. Yellowish white, ferruginous. Sherman, near line of New Milford.

423*b* Feldspar. Snow-white (kaolin.) Kent.

424*b* Feldspar. Decomposed; with decomposed mica and talc. Greenwich, Horse-neck.

424 Albite (*Tetarto-prismatic Feldspar*). Crystallized in cavities and veins in feldspar. Middletown, china-stone quarry.

424*y* Albite. Crystallized and massive; white. Cornwall, north part of town.

424*b* Albite. Massive; bluish white. Haddam, Allen-vein.
425 Albite. Massive; white. Middletown, china-stone quarry.
426 Albite. Massive; granular. Middletown, china-stone quarry.
426*b* Albite. Massive; greenish white. Haddam.
426*y* Albite. Massive; bluish gray (adularia). Thompson.
426*r* Albite. Massive; bluish gray (adularia). Chaplin.
427*b* Albite. Massive; bluish gray (adularia). Union.
427 Albite. Massive; snow-white. Plymouth.
428 Albite. Yellowish white, fine granular, with garnet. Monroe.
432 Scapolite (*Pyramidal Petaline-Spar*). Massive; white. Trumbull.
432*b* Scapolite. Massive; white. Canterbury.
433 Scapolite. Massive; bluish gray. Bolton.
434 Scapolite. Massive; white and reddish white, decomposing. Stonington, near Paugatuck.
435 Scapolite. Massive; white; in small individuals. Stonington, near Paugatuck.
436 Epidote (*Prismatoidal Augite-Spar*). In slender brown crystals in calcareous spar. Monroe.
437 Epidote. Massive; yellowish brown. In hornblende-slate. Woodbury.
437*b* Epidote. In minute crystals; pistachio-green. Hadlyme.
438 Epidote. Crystallized and massive; pearl-gray (zoisite). Monroe.
438*b* Epidote. Fine, granular; pistachio-green (scorza). Haddam, Higganum.
439 Epidote. Massive; dark green, with talc. Bristol.
440 Epidote. Massive; pistachio-green. Killingly.
441 Epidote. In slender, grayish white crystals (zoisite). Vernon.
442 Pyroxene (*Paratomous Augite-Spar*). Crystallized; green. Imbedded in bluish calcareous spar. Trumbull.
442*b* Pyroxene. Massive; white (*sahlite*). Watertown, near Plymouth.
443 Pyroxene. Massive; green (*sahlite*). New Haven, marble-quarry.
443*b* Pyroxene. Massive; greenish brown (*sahlite*). With garnet. Stafford, line of Union.
444 Pyroxene. Massive; white (*sahlite*). Canaan.

444*b* Pyroxene. Massive; greenish gray, with hornblende. Plainfield.

445 Pyroxene. Massive; greenish white. Vernon.

445*b* Pyroxene. Massive; dark green. Sharon, Buck's mountain.

445*y* Pyroxene. Massive; fine granular (coccolite). Reading, near line of Danbury.

445*r* Pyroxene. Massive; bluish white. Canaan, N. of Canaan falls.

445*g* Pyroxene. Massive; bluish white. North Canaan.

446 Hornblende (*Hemi-prismatic Augite-Spar*). In slender, grayish white prisms (tremolite), imbedded in dolomite. Washington, marble-quarry.

447 Hornblende. Massive; white, fibrous (tremolite). With pyroxene in dolomite. Canaan.

448 Hornblende. In yellowish white prisms (tremolite). With pyroxene. Canaan.

448*b* Hornblende. In grayish white prisms, and in plumose fibres (tremolite). Washington.

449 Hornblende. In long, flattened, black crystals. Torrington.

450*b* Hornblende. In small greenish white grains, in dolomite. Stanwich.

450 Hornblende. Massive; black; in large individuals. Danbury.

451 Hornblende. Massive; black; in large individuals. Associated with pyroxene. Danbury.

452 do. do. do. do.

452*b* Hornblende. Massive; brown; granular. Danbury.

453 Hornblende. Massive; radiating; black. Torrington.

454 Hornblende. Massive; black. Preston.

455 Hornblende. Massive; greenish black. Somers.

456 Hornblende. In acicular crystals. Torrington.

457 Hornblende. Massive; black (hypersthene). Litchfield.

458 Hornblende. In slender, brownish crystals (anthophyllite). Guilford.

459 Hornblende. In slender, white crystals (tremolite); in talc. Somers, soapstone-quarry.

460 Hornblende. Massive; grayish black. Contains iron-pyrites. Litchfield.

461 Hornblende. Massive; in radiating, silky fibres (asbestiform tremolite). Greenwich.

462 Hornblende. Massive; in radiating silky fibres. Winchester.

463 Hornblende. Massive; greenish white. In dolomite. Ridgefield.

464 Hornblende. Massive; greenish white. Stanwich.

465 Hornblende. Massive (asbestiform tremolite). Litchfield.

466 Hornblende. Massive; in gray, silky, parallel fibres. Winchester.

466*b* Hornblende. Massive; in white, silky, parallel fibres (paper-asbestus). Washington.

467 Hornblende. In closely interwoven, silky fibres (paper-asbestus). Attached to dolomite. Washington, marble-quarry.

468 do. do. do. do.

469 Tabular spar (*Tetarto-prismatic Tabular-Spar*). Massive; white. In quartz and calcareous spar. Brookfield.

470 Boltonite (*Parachrose Tabular-Spar*). Massive; yellowish green, with talc in dolomite. Ridgefield.

471 Boltonite. Massive; yellow and yellowish green. Danbury.

471*b* Boltonite. Massive. Reading, Hill's quarry.

471*y* Automolite (*Octahedral Corundum*). Massive; dark green, with garnet in granite. Haddam.

472 Corundum (*Rhombohedral Corundum*). Massive; bluish white. In kyanite. Litchfield.

472*b* Corundum. In minute crystals. Color sapphire-blue. In bucholzite. Norwich, falls of the Yantic.

473 Topaz (*Prismatic Topaz*). In small transparent crystals. Trumbull.

474 Topaz. Fragment of a large white crystal. Trumbull.

475 Topaz. Crystallized. Color green. Trumbull.

476 Beryl. (*Rhombohedral Emerald*). Small loose crystals. Monroe.

477 Beryl. Small sea-green crystals in granite. Haddam.

478 Beryl. Greenish white crystals in granite. Monroe.

479 Beryl. Green crystals in large grained, red granite. Glastenbury, Roaring brook.

479*b* Beryl. Massive; yellowish green. Middletown, china-stone quarry.

480 Chrysoberyl (*Pyramidal Emerald*). In yellowish green crystals and massive; with yellow beryl and garnet. Haddam.

481 Iolite (*Prismatic Quartz*). Massive; deep blue. Haddam.

482 Iolite. Massive; pale blue, with anthophyllite and quartz. Haddam.

482*b* Iolite. Massive; deep blue, with garnet in quartz. Norwich, two miles north of landing.

483 Quartz (*Rhombohedral Quartz*). In small prismatic crystals; loose. Haddam.

484 Quartz. In minute crystals, imbedded in zechstein. Guilford.

485 Quartz. Portion of a large crystal. Contains crystals of dolomite. Ridgefield.

486 Quartz. Massive; purple (amethyst), in trap. Southbury.

487 Quartz. In minute crystals, forming druses through ferruginous breccia. Kent.

488 Quartz. Massive; white (common quartz). Woodbridge, near Clark's tavern.

489 Quartz. Massive; white (milky quartz). Roxbury.

490 Quartz. Massive; white (common quartz). New Hartford.

491 Quartz. Bluish. North Guilford, Essex turnpike.

492*b* Quartz. Massive; in large columnar individuals. Color pale purple. Canton, Whortleberry-hill.

492 Quartz. Massive; (*rose-quartz.*) Middletown, china-stone quarry.

492*b* Quartz. Massive; large columnar individuals. White. Long hill, between Groton and Stonington.

493 Quartz. Massive; pseudomorphous. Prospect, near Straitsville.

493*b* Quartz. Massive; drusy. Canton, Whortleberry-hill.

494 Quartz. Massive; cellular. Prospect, near Straitsville.

494*b* Quartz. Massive; cellular and drusy. Kent.

495*b* Quartz. Massive; ferruginous, (iron-flint.) Kent.

495 Quartz. Agate. West Hartford.

496 do. do. do.

497 Quartz. Agate; calcedonic. West Hartford.

498 Quartz. Agate; jaspery; in trap. Cheshire.

499 Quartz. Agate; jaspery; decomposing. Cheshire.

500 Quartz. Agate; jaspery; decomposing. Berlin.

501 Quartz. Heliotrope; a vein in trap. Southbury.

502 Quartz. Jaspery; yellowish gray. New Milford, Candlewood pit.

503 do. do. do. do.

504 Quartz. Calcedonic, with opal. Botryoidal. Cornwall.

504*r* Quartz. Calcedonic, with opal. Contains patches of red calcedony or carnelian. Torringford, in diluvium.

504*y* Quartz. Calcedonic. Carnelian. Torringford.

505 Opal (*Uncleavable Quartz*). A botryoidal coating (*hyalite*) on granite. Haddam, Allen-vein.

506 Opal. A botryoidal coating (*hyalite*) on trap. Southbury.

507 Opal. A botryoidal coating on cellular quartz. Hartford, Rocky Hill.

508 Opal. A botryoidal coating on sandstone. Hamden.

509 Bucholzite (*Prismatoidal Axinite*). In distinct, hair-brown crystals (*sillimanite*). Chester.

510 Bucholzite. In long parallel fibres. Norwich, falls of Yantic.

510*b* Bucholzite. In long parallel fibres; much interlaced. Norwich, falls of Yantic.

511*b* Bucholzite? In long parallel fibres. Stafford, near line of Union.

511 Bucholzite. In delicate fibres coated with talc. Haddam.

512 Bucholzite. In delicate fibres coated with talc. Groton, near Upper Mystic.

513 Tourmaline (*Rhombohedral Tourmaline*). A large brownish black crystal; perfect in form. Monroe.

514 Tourmaline. Several brownish black crystals, imbedded in mica. Monroe.

515 Tourmaline. Brownish black crystals, loose. Monroe.

516 Tourmaline. Brownish black crystals, loose, (regular at one extremity.) Haddam.

517 Tourmaline. Regular crystals of black tourmaline; in albitic granite. Haddam.

518*b* Tourmaline. Small black tourmalines in quartzy mica-slate. Stafford.

518 Tourmaline. Small black tourmalines in quartz. Litchfield.

518*b* Tourmaline. In long slender, black crystals. Haddam. Allen-vein.

519 Tourmaline. In brownish black fibres. Somers.

519*b* Tourmaline. Massive; black. Washington.

519*y* Idocrase (*Pyramidal Tourmaline*). In minute reddish brown grains, with mica in dolomite. Washington.

520 Garnet (*Dodecahedral Garnet*). In large brownish black, dodecahedral crystals, imbedded in quartz. Lyme.

520*y* Garnet. Trapezohedrons; red. Loose crystals. Reading.

521 Garnet. Dodecahedrons; small. In mica-slate. Salisbury.

521*b* Garnet. Massive; brownish red. Plymouth, near Hoadley's factory.

522*b* Garnet. Massive; brownish red. Reading, near line of Danbury.

523*b* Garnet. Massive and crystallized, (*cinnamon-stone.*) Danbury.

522 Garnet. In small blood-red crystals in mica-slate. Stafford.

523 Garnet. In small, pale yellow crystals, in chlorite-slate, altered by trap. New Haven.

524 Garnet. In small transparent red crystals, in granite. Guilford.

524*b* Garnet. In small reddish brown crystals with hornblende and pyroxene, in gneiss. Haddam, Allen-vein.

525 Garnet. In very minute, red, transparent crystals, in eurite. Norwalk.

525*b* Garnet. Large reddish brown garnets, coated by chlorite. Canterbury.

526 Garnet. In small blood-red crystals and grains, (*pyrope.*) Norwich.

526*b* Garnet. In red semi-transparent crystals, with rounded edges. In granitic gneiss. Guilford.

527 Garnet. Massive; fine granular, with quartz. North Madison.

527*b* Garnet. In reddish white and pink crystals, with rounded edges. Stafford.

528*b* Garnet. In blood-red crystals and grains, in mica-slate. Vernon.

528 Garnet. Garnet-sand. Waterford, Millstone point.

529 Garnet. Garnet-sand. East Haven, Light-house.

529*b* Garnet. Pyrope, with minute crystals of kyanite. Thompson, near line of Woodstock.

530 Zircon (*Pyramidal Garnet*). In minute grayish brown crystals, with beryl, chrysoberyl and garnet. Haddam.

530*b* Staurotide (*Prismatoidal Garnet*). In brownish black crystals with garnet. In mica-slate. Salisbury.

531*b* Staurotide. In brownish black crystals with garnet. In talcose mica-slate. Salisbury.

533 Staurotide. Long black crystals. Stafford.

534 Staurotide. Large brown crystals. Bolton.

534*b* Allanite (*Tetarto-Prismatic Melane-Ore*). In blackish crystals. North Killingworth.

535 Sphene (*Prismatic Euruthrone-Ore*). In brown crystals, with pyroxene and feldspar. Canaan.

536 Sphene. In small brown crystals, in blackish green hornblende. Bridgeport, Thatchersville.

537 Rutile (*Peritomous Eruthrone-Ore*). In rounded grains; found in mica-slate. Monroe.

537*b* Rutile. Massive; in blue dolomite. New Milford, northwest corner.

537*y* Magnetic iron (*Octahedral Iron-Ore*). An octahedral crystal. Haddam.

538 Magnetic iron. In small octahedral crystals and grains. North Madison.

538*b* Magnetic iron. Massive. Sharon.

539 Magnetic iron. Massive. North Madison.

539*b* Magnetic iron. Massive. In small grains in talcose mica-slate. Mount Riga.

540 Magnetic iron-sand. Eastern extremity of sea-shore in Connecticut.

540*b* Magnetic iron. In octahedral crystals and grains, imbedded in granite. Stonington Point.

541 Magnetic iron. In octahedral crystals and grains, with sphene and pyroxene, in granitic gneiss. New London.

541*b* Magnetic iron. Massive, in granite. Hadlyme, Selden's point.

542 Magnetic iron. Massive. Winchester.

542*b* Magnetic iron. Massive. Washington, Brown's mountain.

543 Magnetic iron. Massive; fine granular. Newtown.

543*b* Magnetic iron. Massive; compact; with bucholzite. Norwich, one and a half miles north of the landing.

544 Magnetic iron. Massive; fine granular. Reading.

544*b* Crichtonite (*Axotomous Iron-Ore*). Massive; laminated. In quartz. Southbury, in diluvium.

545 Specular iron (*Rhombohedral Iron-Ore*). Massive; in stellularly arranged foliæ. Killingly.

546 Specular iron. Massive; in thin veins. Manchester, copper-mine.

547 Limonite. (*Prismatic Iron-Ore*). Massive. In stalactitic shapes, (brown hematite.) Salisbury, Ore-hill.

548 Limonite. Massive. Mammillary, (brown hematite). Salisbury, Ore-hill.

548*b* Limonite. Massive. Compact, (brown hematite). Kent, Ore-hill.

549 Limonite. Massive. Mammillary; iridescent. Sharon, Indian ore-bed.

549*b* Limonite. Massive. Cellular and ochraceous. Salisbury, Davis' ore-bed.

550 Limonite. Massive. Mammillary; tarnished. Kent.

550*b* Limonite. Massive. Compact. Salisbury, Scovil's bed.

551*b* Limonite. Massive. Disseminated through mica-slate. Salisbury, Davis' ore-bed.

551 Limonite. Massive. Mammillary; iridescent. Sharon, Indian ore-bed.

552 Limonite. Massive. Mammillary and compact. Salisbury, Chapman's ore-bed.

553 Limonite. Massive; cellular, earthy and fibrous. Salisbury, ore-hill.

553*b* Limonite. Massive. Bog iron-ore. Thompson.

554 Limonite. Massive. Bog iron-ore. Colchester.

554*b* Limonite. Massive. Bog iron-ore. A thin coating on quartz. Trumbull.

555 Limonite. Massive. Bog iron-ore. Thompson.

556 Limonite. Massive. Bog iron-ore; contains siliceous sinter. Woodstock.

557 Wolfram (*Prismatic Baryte-Ore*). Massive. In quartz. Monroe.

558 Columbite (*Pyramidal Baryte-Ore*). In small crystals and massive, in granite. Haddam.

559 Columbite. Fragment of a large crystal. Middletown, china-stone quarry.

560 Pitchblende (*Uncleavable Baryte-Ore*). Massive. In pseudomorphous crystals. Middletown, china-stone quarry.

561 Tungstic Ochre (*Tungstic Lusine-Ore*). Pulverulent, yellow; disseminated through Tungsten. Monroe.

562 Yellow uranium-ochre (*Uranic Lusine-Ore*). Pulverulent, straw yellow. Middletown, china-stone quarry.

562*b* Melaconite, (*Cupric Lusine-Ore*). Pulverulent, black, with hydrated oxide of iron. Bristol, copper-mine.

563 Native Bismuth (*Bismuth Malacone-Metal*). Massive, in quartz. Monroe.

564 Copper-Nickel (*Cupreous Eruthleucone-Pyrites*). Massive; color copper-red; with smaltine. Chatham, cobalt-mine.

565 Mispickel (*Prismatic Eruthleucone-Pyrites*). Crystallized and massive; with iron-pyrites and galena. Monroe.

565*b* Mispickel, with blende and galena. Bethany.

566 Mispickel. Massive. Derby.

566*b* Mispickel. Massive. Oxford, Quaker's farm.

567 Smaltine (*Octahedral Eruthleucone-Pyrites*). Massive; with galena and copper-nickel. Chatham, cobalt-mine.

568 Iron-Pyrites (*Hexahedral Chlorone-Pyrites*). Crystallized; in quartz. Newtown.

569 Iron-Pyrites. Massive; in granite with epidote. Bridgeport, Thatchersville.

570 Iron-Pyrites. Crystallized and massive. Orange.

571 Iron-Pyrites. Crystallized in quartzy mica-slate. Stafford.

571*b* Iron-Pyrites. Massive; in dolomite. Brookfield.

572 Yellow Copper-Pyrites (*Pyramidal Chlorone-Pyrites*). Massive; with galena and magnetic iron-pyrites. Trumbull.

572*b* Yellow Copper-Pyrites. Massive; disseminated through mica-slate. Bristol, copper-mine.

573 Yellow Copper-Pyrites. Massive; in sienite, with magnetic iron-pyrites. Litchfield.

573*r* Yellow Copper-Pyrites. Massive; in quartz. Southbury, South Britain.

574*y* Yellow Copper-Pyrites. Massive; in quartz. Orange, south-west part, near Milford.

574 Magnetic Iron-Pyrites (*Rhombohedral Bronze-Pyrites*). Massive; laminated. Trumbull.

574*b* Magnetic Iron-Pyrites. Massive; in mica-slate. Salisbury.

575 Magnetic Iron-Pyrites. Massive; with iron-pyrites. New Fairfield.

575*b* Magnetic Iron-Pyrites. Massive; with iron-pyrites; decomposing. North Madison.

576 Magnetic Iron-Pyrites. Massive. Brookfield.

577 Variegated Copper (*Octahedral Bronze-Pyrites*). Massive; with green malachite. Hartford, Rocky Hill.

577*b* Variegated Copper. Massive; with green malachite in granite. Bristol, copper-mine.

578*r* Variegated Copper; in granite. Bristol, copper-mine.

577 Variegated Copper. Massive, in granite. Bristol, copper-mine.

578 Vitreous Copper (*Prismatic Copper-Glance*). Massive. Cheshire, Gaylord's mine.

578*b* Vitreous Copper. Crystallized and massive. Cheshire, Gaylord's mine.

579 Vitreous Copper. Massive; in sandstone. Granby, Newgate.

580 Galena (*Hexahedral Polypoione-Glance.*) Massive. Brookfield.

581 Galena. Massive. Berlin.

581*b* Galena. Massive. Plymouth.

582 Galena. Massive. Middletown.

583 Galena. Massive. Wilton.

587 Molybdenite (*Rhombohedral Polypoione-Glance*). In scales, disseminated through quartz. Essex.

584 Blende (*Dodecahedral Sclerone-Blende*). Massive. Brookfield, lead-mine.

584*b* Blende. Massive; in dolomite. Brookfield, lead-mine.

585 Blende. Massive. Chatham, cobalt-mine.

585*y* Blende. Massive; with spathic-iron. Roxbury.

586 Blende. Massive. Monroe.

588 Bitumen (*Black Mineral-Resin*). Compact. With dolomite in brown shale. Berlin.

APPENDIX TO THE CATALOGUE.

589 * * * *. Massive, white; in quartz. New Milford, Candlewood mountain.